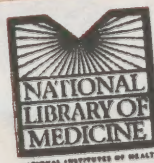




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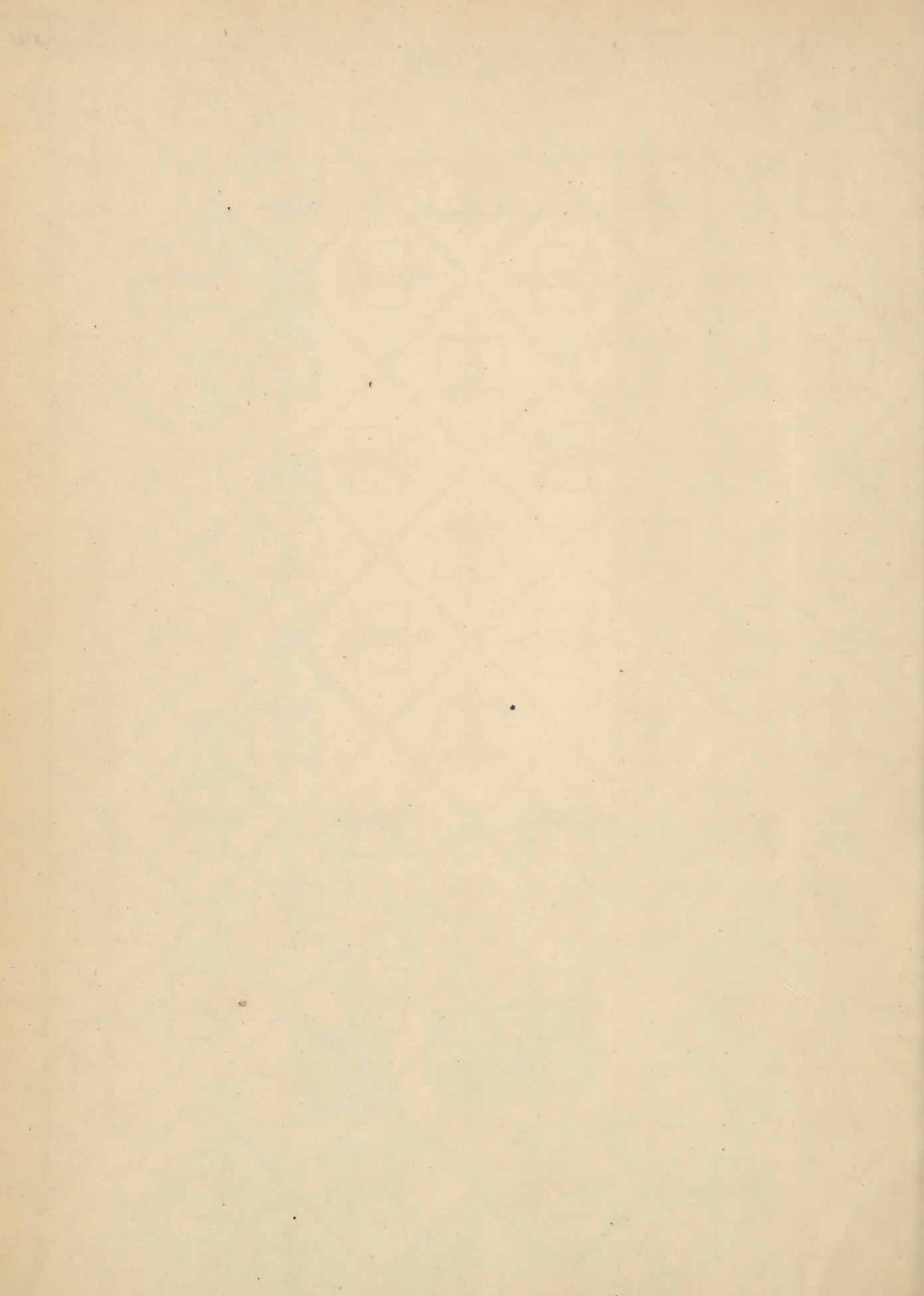
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A HISTORY OF PREVENTIVE MEDICINE
IN THE
EUROPEAN THEATER OF OPERATIONS
UNITED STATES ARMY
1941 - 1945

VOLUME II

by

Colonel John E. Gordon, M.C.
Chief of the Division of Preventive Medicine
Office of the Chief Surgeon, ETO

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It is emphasized that all statistical data in this monograph are tentative and subject to revision when tabulation of individual sick and wounded report cards has been completed.

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A HISTORY OF PREVENTIVE MEDICINE
IN THE
EUROPEAN THEATER OF OPERATIONS
UNITED STATES ARMY
1941 - 1945

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A HISTORY OF PREVENTIVE MEDICINE
IN THE
EUROPEAN THEATER OF OPERATIONS
UNITED STATES ARMY
1941 - 1945

PART III - Epidemiology
Section 6 - Miscellaneous Infections

by
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Chief of the Division of Preventive Medicine
Office of The Chief Surgeon, ETO



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PART III - Epidemiology

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ACUTE INFECTIOUS JAUNDICE

The days are long since past when all fevers with jaundice were collectively called the bilious fevers; and yet the more modern term of acute infectious jaundice contributes little toward better differentiation of jaundice due to infection from the other and multiple causes of this striking clinical sign. It is often applied just as loosely to include several acute infections, some specific and some non-specific; or with equal fault as a synonym for one of the group, leptospirosis icterohaemorrhagica or Weil's disease.

The more important consideration is the frequent failure to distinguish among the various kinds of infectious jaundice a communicable disease which is by far the most common of the lot. It is as independent and distinct a disease as mumps or measles, has a world distribution and indeed is the only one that currently appears in frank epidemics. Reference is made to the disease variously known as simple jaundice, common infective jaundice, non-spirochetal infectious jaundice, epidemic catarrhal jaundice, infective hepatic jaundice and epidemic hepatitis.

The inadequate understanding of the epidemiological behavior of epidemic hepatitis and to a lesser extent of its clinical nature, and the divided opinion about what is and is not to be included within this disease entity is well brought out by the interpretation given the condition in standard texts of the world; and yet this is no newly recognized disease - it has been known for hundreds of years. Its existence as an entity was appreciated even in the days before bacteriological methods had made any headway in separating the several kinds of infectious jaundice. In the course of years this conception has been reinforced by modern clinical study and by well-controlled epidemiological observations.

Primary Infectious Jaundice

Primary infectious jaundice includes those specific communicable diseases having a more or less direct action on the liver parenchyma with production of jaundice as the leading symptom. The three well-known examples of primary infectious jaundice are Weil's disease, yellow fever and epidemic hepatitis.

Distinct from those are a number of infectious processes, some specific and some non-specific, which lead secondarily and

irregularly to jaundice as a complication. The more common specific diseases include relapsing fever, malaria and typhoid fever. Jaundice may follow pneumococcus pneumonia, also erysipelas and scarlet fever among hemolytic streptococcus infections. Typical of non-specific infections leading secondarily to jaundice are general sepsis of varying origin, and ascending infection of the bile tracts following gastroduodenitis. This discussion is not concerned with the above group although problems of clinical differentiation are more frequent than commonly appreciated.

Weill's Disease.--The detailed clinical descriptions of Weill in 1866 served to differentiate the first of the three primary forms of infectious jaundice from other types. Because Weill's disease has a wide geographic distribution and also because epidemic hepatitis is frequently and erroneously considered a milder form of the same process, the general clinical characteristics are briefly stated. They differ materially from those of epidemic hepatitis.

Weill's disease has a sudden onset with profound prostration, aching muscular pains and a high fever characteristically followed by jaundice, evidences of renal failure and a hemorrhagic diathesis. The case fatality is about 30%. The usual distribution is sporadic, commonly in small occupational groups, involving miners, butchers, fish cleaners or sewerage workers; and never in the extensive epidemics so characteristic of the other two kinds of primary infectious jaundice. The epidemiology of Weill's disease and its clinical nature have been the subject of extensive review. The disease was rare in the European Theater, although existing both in Britain and on the Continent.

Yellow Fever.--Yellow fever is just as firmly established as a disease entity, clinical recognition having long antedated that of Weill's disease although the specific filtrable virus was not discovered until 1928. No cases of yellow fever occurred among troops of the European Theater nor indeed among any troops of the United States Army in any theater of the world.

Epidemic Hepatitis.--The third specific infectious disease having jaundice as the principal symptom is epidemic hepatitis, a benign condition in comparison with leptospirosis or yellow fever, of far reaching geographical distribution and with a definitely greater incidence.

Infectious Jaundice in the European Theater

The records of the theater include 22,223 cases of acute infectious hepatitis for the four years of military operations. The reported cases probably include a collection of diverse conditions. Those of the first year were principally instances of an

acute disease having a low degree of communicability, if actually it was communicable at all. The illness was the result of previous immunization of soldiers against yellow fever with an antigen which contained an icterogenic substance, presumably of viral nature.

The principal element contributing to this group of cases was representative of a specific infectious disease, with well-marked ability to pass from person to person and known as epidemic hepatitis. That some infections of this nature were also included in the reports of 1942 is certain. It became the predominant form of infectious jaundice as increased numbers of cases occurred in each succeeding year.

The third type of acute illness characterized by appearance of jaundice was a condition occurring as an aftermath of treatment for syphilis with arsenicals. Its relation to epidemic hepatitis remained undetermined.

A form of acute liver disease was noted with increasing frequency to follow treatment of patients by transfusion with whole blood or by parenteral injection of serum, plasma or other blood fractions. The condition was definitely akin to the jaundice which followed yellow fever vaccine and the two were commonly termed homologous serum jaundice.

Finally and of relatively rare occurrence were scattered cases of leptospirosis.

The broad distributions of acute infectious jaundice among troops of the European Theater will first be presented, together with a comparison of the incidence in Great Britain and that which occurred on the Continent during the time operations took place in both areas. The experience of the European Theater will be compared with that of other theaters of operation during the period of the war.

Annual Incidence of Infectious Jaundice, ETOUSA

Acute jaundice among American troops in 1942 was almost wholly related to homologous serum jaundice arising from the treatment of soldiers about three months previously with vaccine against yellow fever which contained an icterogenic substance. The outbreak was short lived and extended only through August 1942. Some instances of epidemic hepatitis were assuredly included within the reported cases of May to August of that year, but the majority of the 1395 cases listed in those months were a part of that incident. (Table 1)

Cases of infectious hepatitis reported in the course of the next year were neither numerous nor significant. They were clinically typical of epidemic hepatitis and distributed to considerable

extent as isolated cases, although occasional small groupings occurred among units of the command corresponding to the limited outbreaks which are so characteristic of that disease under endemic conditions.

Epidemic hepatitis had been a commonly observed disease in Great Britain for many years, apparently of somewhat greater frequency than in the United States, and consequently it was to have been anticipated that the rates for American troops would be greater than had characterized American military practice under peacetime conditions in continental United States. Some few cases within this period were probably of the homologous serum jaundice type arising through use of blood derivatives, but casualties were few and jaundice infections of this type likely minimal, although records and indeed medical appreciation of the problem were then generally lacking.

Epidemic hepatitis took on a distinctly added importance in October 1943 when American troops returned to the United Kingdom from Africa. It had been a prevalent disease in that region, one of the most important of medical conditions. When four divisions of infantry and the First Engineer Special Brigade returned to Britain they brought the disease with them, as they did malaria. The attack rate for November 1943 was 12.9 per 1000 per year and for individual units of the command was of course much greater, for jaundice in the theater was at that time largely a problem of these troops.

The usual seasonal decline was noted in the early spring of 1944, although the data fail to give a true indication of the trend because of the excessive dilution of the troops principally effected through the continued arrival of new divisions in preparation for the forthcoming operations on the Continent.

The final year of the war was marked by an extreme prevalence of acute infectious jaundice. The seasonal increase ordinarily evident in late summer and early autumn, was in this instance delayed until October. Thereafter the monthly incidence was progressively greater each month and reached a maximum of 16.9 in April 1945. The rates were still excessive in June, namely 6.5 per 1000 per year, which is definitely high for that time of the year.

The general epidemic situation in the Theater, which had arisen through seeding of troops by units returning to make up the First Army, was again exaggerated by the introduction into the theater in November of three divisions of infantry and attached troops which made up the Seventh Army. The three divisions had suffered severely from epidemic hepatitis in Italy and as had happened in Britain, they brought the disease with them. The Seventh Army was likewise greatly augmented by the inclusion in forces of that command of a

number of newly arrived divisions from America made up essentially of susceptibles to hepatitis. These troops were included with the divisions already affected, in such a way that infection readily spread to the fresh units.

Comparative Incidence, United Kingdom and Continent.--

Infectious hepatitis was much more frequently observed in 1944 than in any previous year of the theater. Individual records for the troops stationed in the United Kingdom and those concerned with operations on the Continent showed an increased incidence of acute **jaundice** in both locations, but much more marked on the Continent than in Great Britain. (Table 2) For the period September 1944 to June 1945, the rate in Great Britain was 5.6 and for the Continent, 9.0. The preponderance of the disease on the Continent was wholly a matter of the later months of that period. The behavior of epidemic hepatitis among continental troops in the autumn of 1944 conformed with preceding experience and indeed the rates were measurably lower than in the United Kingdom. The first notable increase was in December at which the continental rate was still one-half that of the United Kingdom. Thereafter the rates for continental troops increased each month to reach a maximum of 18.7 in April.

Jaundice in Various Theaters of Operation

For the Army as a whole infectious jaundice was one of the most frequent of all communicable diseases. For the period of the war from January 1942 to June 1945, the number of cases reported was 142,636. Most of these occurred among troops stationed overseas; the rate for troops of continental United States was 2.61, compared with 13.5 for troops of all theaters of operation.

The Mediterranean Theater maintained a consistently high rate. During the early days of the theater in late autumn of 1942 the number of cases was negligible, but jaundice soon became evident in epidemic proportions. The frequency in 1943 was 36.8 per 1000 strength per annum and the rate did not decrease in succeeding years; rate for 1944 was 22.7, and that for 1945 was 25.8

The disease was next most frequent in the Southwest Pacific area, with a rate for the entire war experience of 25.9. Well-marked variations in frequency occurred from year to year in contrast to the more consistent behavior of the disease in the Mediterranean, in that for the first year of 1942 the rate was 23.0, it dropped in 1943 to a very favorable level of 2.8, but again increased to give the highest rate for any theater of any year of 61.9 per 1000 per year in 1945.

Troops of the Alaskan Theater occupied third place, largely because of the high incidence of homologous serum jaundice experienced in the first year of operations. Epidemic hepatitis was apparently

a rare disease in that locality since rates in succeeding years were negligible.

The European Theater occupied sixth place among the nine theaters of operation with a rate for the entire period of activities of 7.0. The 1942 level of 21.5 was directly attributable to homologous serum jaundice. The disease existed at a low level of frequency in 1943, 6.8; and was still less common in 1944 when the rate was 2.6. The 1945 upsweep was material and decided, for it reached 10.9 per 1000 per year for the first six months of 1945. (Table 3)

Special Epidemiologic Problems

Individual consideration will now be given to the five particular problems associated with acute disease characterized by rapidly developing jaundice. Comment will be restricted to events which occurred among American troops of the Theater, although acute infectious jaundice was widely spread through the British civilian population, and was a matter of concern among British troops. The studies and contributions of joint committees and commissions as well as those of individual British investigators will be drawn on to the extent that they bear on the problems of American troops.

LEPTOSPIROSIS ICTERHAEMORRHAGICA (WEIL'S DISEASE)

Weill's disease was neither the first nor the most important problem in primary acute infectious jaundice to be presented to medical authorities of the European Theater. Since it is perhaps the best known of these conditions to American physicians, and because it frequently confused the interpretation of existing epidemiologic phenomena, its relative place among these conditions is briefly defined, principally to emphasize its lack of importance and to clarify the situation.

Leptospirosis was not recognized among United States troops until operations started in Continental Europe, and no more than ten cases were included in the entire medical record of the theater. With the exception of a single case in Great Britain, all originated from troops serving on the Continent—seven in late 1944 and two in 1945. The following case report is illustrative of the disease.

EPIDEMIOLOGIC CASE REPORT NO. 1 - Two weeks before admission to hospital the patient fell into a small pool of stagnant water on the Brest Peninsula, where French women frequently washed clothing. He suffered a small laceration of the left wrist which was not treated until the following day. One week later he developed coryza, a mild non-productive cough, anorexia, and had a slight chill. Physical examination at the time of admission to hospital was essentially negative

except for moderate injection of the pharynx and coarse rales in the right lower lung field. The diagnosis was early pneumonia and sulfadiazine was administered. The temperature continued at 101°F to 103°F for three days. Roentgen examination of the chest demonstrated no abnormalities. Subsequently the patient complained of severe pain in the calves of both legs, headache was present and injection and lack of luster of the conjunctivae were noted. During the next two days an intense icterus of rapid evolution and a peculiar orange color became evident. An epistaxis was of such moment as to require nasal packs, and spontaneous purpura of the skin were noted. Vomiting was severe, and fluid and food intake by mouth was impossible. Leptospira were observed in the urine. The liver and spleen were barely palpable. The patient showed definite improvement after treatment for three days with penicillin. An agglutination test performed at the Pasteur Institute was reported positive for leptospira icterohaemorrhagica. Urine and blood cultures proved negative. A guinea pig inoculated with blood from the patient, failed to develop the disease. Complete recovery followed and an agglutination test performed four weeks after the onset of the disease was positive in a titer of 1 to 1,000,000 for leptospira icterohaemorrhagica.

Because of the extensive and continued presence of an outbreak of epidemic hepatitis among troops of the European Theater, the diagnosis of Weil's disease was made with considerable frequency. In most instances the evidence failed to support the diagnosis, and it is believed that even the small number of reported cases is in excess of the number that actually occurred.

For the entire United States Army during the war period, 18 cases of leptospirosis were reported; 17 among troops serving in overseas theaters of operation. Other than the European Theater, the greatest number was noted in the Southwest Pacific area with six, and a single case came from the Africa-Middle East Theater. (Table 4)

EPIDEMIC HEPATITIS

Epidemic hepatitis was easily the most important of the fevers associated with jaundice. The disease appeared rather promptly after the first American troops landed in North Ireland, it continued to be a significant problem during the entire stay in the United Kingdom, and it became truly epidemic during the year of operations on the Continent.

Proper understanding of what is to be included within the clinical limits of the condition and the appreciation of its existence as a specific infectious disease, have been inhibited as much as anything by the variety of names that have been applied to the disease.

Nomenclature

Early reports speak of the disease as "epidemic jaundice" which is a good enough name since it stresses the principal symptom and the epidemic nature. However, in 1864, Virchow reported what subsequent experience has shown to be a rare sporadic form of infectious jaundice, and called it "acute catarrhal jaundice". At autopsy a plug of mucus developing from an acute gastroenteritis was found to have lodged in the common bile duct and produced an obstructive jaundice. Unfortunately this pathogenetic mechanism was accepted for years as the pattern for all mild sporadic jaundice of infectious nature. It soon was evident that a clinically indistinguishable condition occurred in frank epidemics and so the term epidemic catarrhal jaundice was introduced. There is no evidence that catarrhal jaundice as described by Virchow has ever occurred in epidemics.

A variety of evidence--clinical, pathological and epidemiological--gradually gave proof that this disease was not a local infection of the gastrointestinal mucous membrane, but a general infection with primary localization of the infectious agent in the liver parenchyma; and that it was furthermore a specific communicable disease with a well-defined epidemiological behavior. As a result of this changing concept, a variety of names were introduced to define the epidemic disease.

The disadvantages of the term infectious jaundice have been mentioned. The French usage of benign jaundice or of simple icterus scarcely gave emphasis to the epidemic nature of the condition. "Jaunisse des camps" was a favored war time name in 1918. British writers used "common infective jaundice" or "non-spirochetal infective jaundice".

In 1919, Lingstedt suggested "epidemic hepatitis" as most suitable, in analogy with epidemic parotitis for mumps. This name emphasizes the primary pathology of the disease, its ability to occur in epidemics and its specific nature. It has the advantage over epidemic jaundice of cutting sharply away from any confusion with catarrhal jaundice. What is more important, the numerous atypical infections occurring in epidemics and not proceeding to jaundice can be included logically within a term like epidemic hepatitis. Used almost universally in the Scandinavian countries where much attention has been given this disease, it is preferred by most German and continental workers. In England, Findlay and others speak of "infective hepatitis". More general use of the term "epidemic hepatitis" would conceivably lead to better appreciation of the true nature of the disease.

For purposes of clarifying further epidemiologic discussion it is deemed desirable to present the characteristic clinical features

of epidemic hepatitis as manifested in clearly recognized epidemics, accepting this as the classical type of the disease. For the moment attention will deviate from any possible common relationship with the many clinically similar sporadic cases of jaundice that have occurred so frequently in recent years. The jaundice in association with arsphenamine treatment of syphilis will be disregarded, as will the more serious condition of acute yellow atrophy of the liver, and the disease known as homologous serum jaundice. The aim here is to define a clinical type.

The Clinical Disease

The clinical course of epidemic hepatitis has two well-defined stages, a situation not always appreciated because so commonly patients first come under medical care after jaundice has appeared. With opportunity for full observation, the two stages are distinct. The first presents all the appearances of a general infection with fever, gastrointestinal symptoms, but without jaundice, while the second is introduced by the appearance of jaundice and ordinarily is free from fever.

The infection develops progressively and a sudden onset is rare. The patient is irritable and experiences loss of appetite; there is vomiting, and very regularly pain or at least a sense of fullness in the region of the liver. Headache is fairly common, sometimes dizziness, and rather frequently a sense of tiredness and weakness of the extremities. Headache is to be expected. At this time much variation is encountered in respect to localizing symptoms. Sometimes only evidences of systemic infection are present, while some epidemics are characterized by an initial upper respiratory infection. More commonly, early symptoms are associated with disturbances of the gastrointestinal tract, constipation or mild diarrhea. The fever is low grade, ordinarily about 101°F but sometimes as much as 104°F. Early observation of the illness may be necessary to determine the presence of fever, with some reason to believe that it is more constant in children than in adults. Under all circumstances, the temperature tends to return promptly to normal limits so that the course is afebrile when jaundice appears.

As the infection progresses, the disturbances referable to the liver become more pronounced and shortly before jaundice develops are sometimes so marked as to produce a colic-like pain of sufficient severity to lead to confusion with appendicitis or cholelithiasis. The spleen is occasionally enlarged, but by no means regularly. The duration of the first stage is variable, ordinarily three to ten days. A day or so in advance of jaundice the urine becomes darker and the stools lighter, although complete acholia is uncommon.

Jaundice is the outstanding sign of the second or icteric stage of epidemic hepatitis. The sclerae are affected first and

sometimes no more than the sclerae. The usual sequence is progressive yellowing of the face, neck, body and limbs. Perhaps ten percent of patients complain of itching, adults more commonly than children. The jaundice lasts ordinarily for a week or two, sometimes persists over four weeks and rarely a month, with recorded instances of eight weeks duration. Once jaundice appears the patient promptly feels better, the appetite returns and gastrointestinal symptoms disappear. Herpes labialis is a rare accompaniment in contrast to Weil's disease.

The general course of the illness is mild, although generally admitted to be more severe in respect to adults. Complications are seldom introduced and convalescence is brief, about 2 to 4 weeks.

A striking uniformity in clinical behavior has been observed from descriptions of various epidemics in the course of this experience, and in many parts of the world over many years, giving weight to the belief that epidemic hepatitis is an entity and therefore due to a specific infectious agent. Naturally variations from the clinical course are encountered during a given epidemic, but these are largely a matter of degree. The first stage may be indefinite or absent, with jaundice the first evidence of the condition. By contrast, the infection may not progress beyond the initial stage, with jaundice remaining absent or limited to the slightest yellowing of the sclerae. Recognition of such abortive infection depends upon clinical evidence and association with outspoken epidemics, since the infectious agent has not been demonstrated. Despite the usually good prognosis, patients with this disease sometimes develop the manifestations of acute or sub-acute yellow atrophy with a fatal outcome.

Incidence in the European Theater

Epidemic hepatitis was one of the earliest reported communicable diseases among American troops in the European Theater. Members of the 151st Field Artillery Battalion of the 34th Division contracted the disease in North Ireland in April 1942 and the illness led to confusion with the outbreak of homologous serum jaundice then so prevalent in that locality.

The disease continued to occur in North Ireland among both British and American troops, as well as in the civilian population. It was consistently and regularly present in Great Britain from the time that troops were stationed there, although the incidence was not great until troops arrived from Africa and Sicily.

Jaundice Among Troops Returning from Africa and Sicily

In contrast to malaria which was common in all four divisions of infantry and the 1st Engineer Special Brigade which

returned to Great Britain from Africa in November 1943, only the 1st Infantry Division had a serious problem in respect to infectious hepatitis. Prior to their arrival in Great Britain epidemic hepatitis had appeared in all five units which were to furnish the nucleus for the First United States Army, but never to an extent comparable to that for the 1st Division.

The introduction of the disease in epidemic proportions among troops of Great Britain served to initiate an increasing incidence of this communicable disease, which eventually involved troops of the theater generally. It is not to be assumed that the well-marked epidemic which became evident in the spring of 1945 arose wholly from this source. The disease among troops from Africa merely gave impetus to the situation. Epidemic hepatitis was repeatedly introduced by Air Force units returning from Africa and Sicily, and the arrival of troops of the Seventh Army in the autumn of 1944 contributed a further extensive focus of infection. The existing endemic prevalence of the disease in both Great Britain and on the Continent added other reservoirs of infection.

2nd Armored Division.—The Second Armored Division had experienced a measurable amount of epidemic hepatitis in Sicily in the period immediately preceding deployment in Great Britain. The disease first made its appearance in August, 1943. In the immediately succeeding months about 75 patients were sent to hospital. The Division Surgeon was of the opinion that an appreciable number of others with outspoken but mild jaundice did not report ill, and that a number of mild cases without icterus remained undetermined. During the first week that the division was in England, 3 December 1943, seven cases were reported and in the next two succeeding weeks two cases and five cases came to record, but thereafter the division was essentially free from epidemic hepatitis except for sporadic attacks rarely involving more than a single patient during a given week. Throughout operations in France, the division experienced little difficulty.

82nd Airborne Division.—The 82nd Airborne Division participated in operations in North Africa and in Sicily and was stationed for an appreciable period of time in Naples. Epidemic hepatitis was particularly prevalent in the division while in Italy, with 370 reported cases in 1943. The epidemic had essentially passed by the time the 82nd Division arrived in Great Britain in the week of 10 December 1943, since only four cases were observed that week. No outspoken problem was ever again noted although a source of infection evidently existed, for most weeks of the succeeding year and a half found at least one reported case. Weeks with two or three cases were frequent and occasionally as many as five occurred. The rates were consistently those of a continued endemic prevalence.

9th Infantry Division.—Jaundice had never been a principal consideration of the Ninth Infantry Division during the campaign in

Africa or in Sicily, for the regular reports of the division failed to mention the disease. The unit would appear to have been exposed to the infection shortly before departure from Palermo, as had the 1st Infantry Division, for during the first week in Britain, 3 December 1943, 16 cases of hepatitis were reported, 19 more the next week, and 11 in the week thereafter. The disease continued to be relatively prevalent during January but in the period of the assault on Normandy and in the European campaign, the history of the division was characterized by no more than an ordinary endemic prevalence.

1st Infantry Division.--The 1st Infantry Division had the most serious problem in respect to epidemic hepatitis. Throughout the Tunisian campaign, the period of organization and regrouping in Algiers, and the operations in Sicily, the division had no hepatitis other than a single isolated case early in the Tunisian phase.

The disease first appeared while troops of the division were in bivouac in the Palma Di Monti area in South Sicily after the conclusion of the campaign. A striking increase in reported cases took place from the week of 27 August. The peak of the outbreak occurred on board ship in transit to Great Britain in the week of 22 October, and the outbreak continued in the United Kingdom through December and January. Not until the first week in February 1944, was a stable situation reached, with epidemic hepatitis again at a reasonable endemic level. Thereafter the division experienced relatively little concern over the disease, although the rate of incidence did increase slightly during the general excess prevalence of the spring of 1945.

The men of the First Division began to develop jaundice directly the campaign in Sicily was over. Thus a sergeant in the Counter Intelligence Corps, in a unit consisting of only five enlisted men and one officer, stated that one of the four men developed jaundice on August 21 and another on September 1. The sergeant became jaundiced on 22 October, having shared a room with the other two men. From a number of accounts, it would appear that patients with jaundice were frequently kept in quarters in Sicily rather than hospitalized. About one-half of the 52 patients interviewed when the division landed in Great Britain stated that one to nine members of their company had jaundice in either September or October prior to embarking. All agreed that jaundice was thoroughly prevalent in the camps at Licata and Palma; for example, one man stated that nine others of his unit developed jaundice at about the same time that he did on 1 October, that none went to the hospital, but all remained in quarters. Another patient stated that six of his company had had jaundice in September. Altogether, thirty-six men developed jaundice while in transit in England.

A battalion medical officer who made it a practice to observe fevers for several days before instituting treatment for

malaria stated that a small number of men came in with temperatures of 103°F or 104°F which fell to normal within a few days, and were subsequently followed by jaundice.

The actual incidence of jaundice in the 1st Division at the peak of the outbreak cannot be satisfactorily determined. Between 15 October and 15 November, 190 cases were reported. Many of the men, but more especially the officers, preferred to continue on a duty status although jaundiced. Medical officers of the division estimated that approximately one-fifth of cases were of this nature and consequently not reported, and that 300 cases for the division up to the time it arrived in Britain would be a conservative figure. This estimate gives no consideration to cases without demonstrable icterus. Based on the strength of the division, the number attacked was about two percent of the total command.

Separate figures for the 18th Regiment of the 1st Division indicated that 173 cases of jaundice were reported for that unit, which had a total strength of 2903. The attack rate was thus close to six percent. The 1st Battalion of the 18th Regiment had 63 cases or an incidence of 8.6 percent among 731 men. Of 46 officers of the 1st Battalion, 8 or 22% became jaundiced. An excessive rate for officers was also true of other battalions; the 3rd Battalion for example had 12 patients with jaundice, 4 of whom were officers, and the Provisional Battalion had 30 officers, 6 of whom developed jaundice.

No reasonable explanation could be determined for the high rates in the 1st Battalion, which apparently bivouac'd under similar conditions to the others. It was the only battalion of the regiment to go on a recreational convoy to Palermo in early October.

General Epidemiologic Considerations.—The outbreak of epidemic hepatitis among troops returning from Africa and Italy presented no unusual features, and indeed was much like the outbreaks described among German and British troops in that area. The diagnosis was substantiated by a number of considerations. The seasonal incidence in the late summer and early autumn, the slowly rising epidemic curve and the clinical features were all characteristic of epidemic hepatitis. Furthermore, hepatitis had been reported as epidemic in the civilian population of Sicily.

The troops have been through a campaign where they were subjected to severe physical exhaustion, unappetizing and inadequate rations, and loss of weight. After the campaign, they camped in an area where malaria and sandfly fever were highly endemic. The food was only slightly better than before and diarrhea was prevalent, conditions similar to those associated with outbreaks of epidemic hepatitis among British troops.

The association of jaundice and malaria was confusing. Many medical officers apparently treated most significant fevers as malaria since a definite diagnosis of malaria was frequently impossible under field conditions. A proved association between the two diseases would appear unsubstantiated.

While the troops were crowded on transports, the opportunities for contact infection were at a maximum. The effect is probably to be observed in the secondary rise which took place after troops landed in Great Britain, and in the prolonged course of the epidemic beyond the usual expectancy for this condition. The secondary peak of the outbreak was about one month after the original height of the epidemic. (Figure 1)

The greater frequency of epidemic hepatitis among officers as compared with enlisted men had been a frequent and consistent observation among British troops where similar epidemics had occurred. Interviews with officers of the 18th Infantry Regiment indicated that jaundice was also measurably more frequent for officers than for enlisted men. Officers even with marked jaundice were particularly prone to remain on a duty status. The existence of such cases was only detected by interviews with unit medical officers, for they were not entered officially on division records.

A review of the 216 cases of jaundice reported by the 1st Division from their arrival in the theater through the week ending 3 December 1943, showed that 17 were officers and 199 were enlisted men. The distribution was essentially the same as that for the theater during 1942 and the first five months of 1943.

Three authenticated instances of relapse of jaundice were noted among patients admitted to hospital. Prodromal symptoms did not precede the second attack; patients noted only that they again became heavily jaundiced and that they were more readily fatigued. There were no deaths among patients of this outbreak.

The disease occurred with apparently equal readiness during active fighting, under field conditions in bivouac, with relative rest in houses in Sicily, on board ship and under training conditions in requisitioned houses and billets in England. Observation of this epidemic led to the distinct impression that once introduced into a unit, the infection continued to spread through three or four more monthly generations. That troops from the Mediterranean area served as the source of infection for other units of the European Theater was clearly demonstrated by the following experience: A bakery unit of 4 officers and 160 men left the United States on 13 October 1943, landed in Glasgow on 19 October and immediately moved to Kettering. The unit was divided on 18 November with the 3015th Company going to one location and the 3031st Company to Dorchester, where 77 men were housed in Liberty

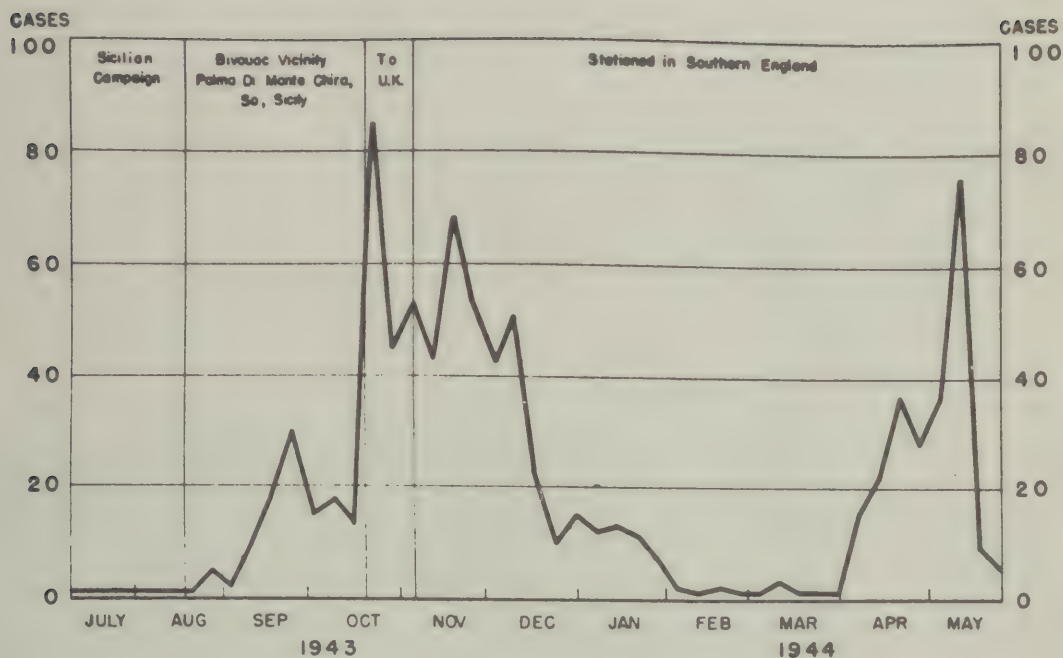


Figure 1.

Epidemic hepatitis in the First Infantry Division, European Theater of Operations, U.S. Army, number of cases by weeks, 16 July 1943 to 26 May 1944, inclusive.

Hall. They slept in three-tier bunks and ate at a mess which also served troops recently returned from the Mediterranean Theater. Jaundice appeared among members of the 3031st Bakery Company 41 days after the first contact with troops from Sicily. Nine cases of jaundice corresponding to 12 percent of the command occurred within a space of 9 days in well-nourished and rested troops recently arrived from America. The 3015th Bakery Company remained free of jaundice.

Epidemic Jaundice in an Air Force Unit

The circumstances associated with the 113th AAF Station in April 1944 served to demonstrate some of the factors associated with the spread of epidemic hepatitis. This station was used as a final training center for Eighth Air Force replacements and new units. The average length of stay was only a few weeks and large numbers of men passed through the station. Approximately 20 units had been assigned for varying periods during March 1944, of whom at least nine had been transferred prior to an investigation brought about by the appearance of jaundice on 25 March 1944. The onset of subsequent cases of clinically definite epidemic hepatitis is shown in Table 5.

In addition to the 31 patients with hepatitis at AAF Station 113, other air force stations were found to have sent an additional 48 patients to nearby hospitals, of whom 38 had been at AAF Station 113 sometime during March. Since the usual incubation period for epidemic hepatitis is about four weeks, and since the disease was not unduly prevalent at other air force stations than AAF Station 113, the outbreak at that location appeared to be the likely source of infection.

Only enlisted men were involved. The 69 cases of hepatitis were determined to be distributed geographically at the probable time of infection among all living sites of the station with the exception of the officers' site, and among all working sites with the exception of the hospital. With two exceptions, the patients included only men employed in ground duty in strictly Air Force organizations.

A common factor to all was the consolidated enlisted men's mess which at the probable time of infection was feeding 2600 men at each meal. The facilities were greatly overtaxed according to the statement of the mess officer and the mess kit laundry was inadequate. The first patient with jaundice worked on the permanent night Kitchen Police detail at the mess until sent to hospital.

The epidemic would appear to have arisen as the result of direct or indirect contact infection with the original patient

during the pre-icteric stage of the disease. The median onset for all patients, excluding the first case, was 19 April; and this was exactly 25 days after the first patient went to hospital or approximately 28 days since the beginning of the pre-icteric stage of his illness. Accepting that period as being from 19 March to 25 March, every one of the 38 patients who subsequently became ill elsewhere with epidemic hepatitis had been at AAF Station 113 at that time.

Jaundice Among the Armies on the Continent

The outbreak of jaundice of 1943-1944 among American forces in Britain was essentially an imported epidemic from the Mediterranean Theater. It largely involved the returned units but extended to others of the area in the United Kingdom to give a sizeable outbreak. In extent and significance, it failed to approach the epidemic of hepatitis that developed in the following year of 1944-45. The outbreak of the first year followed the usual seasonal curve and had largely subsided by the end of February 1944. The rates for the Army in Europe compared very favorably during the summer with those of the summer of 1943, which may be taken as an ordinary year of endemic prevalence. The rates for 1942 had little to do with epidemic hepatitis, for the jaundice then prevalent was almost entirely homologous serum jaundice.

The epidemic of 1944-1945 was a feature of Ground Force troops. (Table 6) Epidemic hepatitis continued to be present in the United Kingdom and the incidence there was somewhat above normal expectancy, but the real epidemic phenomenon was manifested on the Continent. Little or no connection would appear to exist between the outbreaks of the two years.

An understanding of the battle line in Western Europe is essential to proper interpretation of the course of the epidemic. The Third Army was in the line next to the Seventh, and the First was on the other flank of the Third. The Ninth Army held the opposite end of the line in Holland. Interchange of units was most common between the Third and Seventh, less so with the First and almost non-existent with the Ninth Army.

It has been demonstrated that jaundice among elements of the First United States Army in Britain had largely burned itself out by the spring of 1944, when those troops went to the Continent. Jaundice continued to be present in that organization, indicating that reservoirs of infection were maintained, but their significance was not great. The First Army had relatively little jaundice during 1945 until March when the rate increased to 6 per thousand per year. The peak of incidence came in April with a rate of 12.4 and the disease continued at a level of about 8 per thousand during May.

The rates for the Third Army were much the same as those of the First Army. A gradually increased frequency of the disease became evident in January and reached a peak of 42 per thousand in April. The rate still continued high in May with 10 per thousand. In general the experience of the Third Army was somewhat more serious than that of the First.

The Ninth Army had relatively little jaundice at any time and while increased rates in the late spring of 1945 were also noted in this organization, the maximum prevalence in April did not exceed 5 per thousand per year. The real problem and the center of the epidemic in Continental Europe lay with the Seventh United States Army.

Epidemic Hepatitis in the Seventh Army.---All divisions of the Fifth Army in Italy had a serious experience with epidemic hepatitis, and the Mediterranean Theater as a whole had much more jaundice than any other theater of operations. Epidemic hepatitis apparently involved the several divisions promptly after their entrance into Italy, and rates for the disease were maintained at a high level throughout their operation in the field. Three divisions of the Fifth Army were of special significance to the European Theater because they formed the nucleus of the Seventh United States Army which invaded Southern France in August 1944. These three divisions constituted the source of infection for the extensive epidemic of hepatitis that developed among troops of the European Theater the following winter and spring.

Detailed information on the frequency of epidemic hepatitis in the 36th Division, the 3rd Division and the 45th Division of Infantry are available from late September 1943. They demonstrate the extent to which jaundice was prevalent in these units during the time they served in Italy. (Figure 2, Table 7) Epidemic hepatitis gained an early start in 1943, judged by the usual seasonal distribution of the disease, for jaundice was already a commonly existing disease in September in two of the divisions, the 3rd Infantry Division and the 45th Infantry Division. It became manifest about a month later in the 36th Division. The 3rd Division was the first and the most heavily infected. Although the epidemic tended to subside in all three divisions in March and April, excessive rates were nevertheless maintained throughout the summer, so that jaundice was a commonly existing disease when the three divisions landed in Southern France on 15 August 1944.

The entrance into an active campaign in the field was coincident with the usually anticipated seasonal exacerbation of epidemic hepatitis. The conditions encountered probably contributed to a greater incidence of the disease than would otherwise have occurred. The heavy reinforcement of all three divisions during succeeding months provided a continuous flow of susceptibles into an infected medium.

Jaundice was maintained at a high level throughout the autumn. When the three divisions were incorporated into the European Theater on 1 November 1944, the rates of the Third Division were 30 per thousand per year, those for the 36th Division were at the same level and the existing attack rate for the 45th Division was 33 per thousand per year. This was greatly in excess of theater experience, which at that time was 2.1 per thousand per year.

The situation remained essentially unchanged in all three divisions in succeeding months of 1944, but January saw a greatly increased frequency with a maximum rate of 75.4 eventually attained by the 45th Division in the week of 26 January 1945. Replacements appeared to have been continually infected with the virus of the disease by their close association with the older members of the divisions. The epidemic in the Seventh Army as a whole took a decided upward swing as new divisions unaffected by jaundice were added to the troops of the three veteran divisions.

100th Infantry Division.--The 100th Infantry Division arrived in Marseilles from the Zone of the Interior in September 1944, with a previous history of essential freedom of epidemic hepatitis. The Communications Zone troops of Delta Base Section with whom they first had contact were likewise from Italy, but jaundice was never as prevalent in Service Forces as among Ground Forces of that command. Furthermore, intimacy of contact was relatively low grade, for the 100th Infantry Division, like most units of the line engaged in training and in preparation for combat, functioned as an independent unit with no more than the usual contacts in the course of leave and pass. Such cases of epidemic hepatitis as appeared during the autumn corresponded to no more than a low grade endemicity. On 1 November 1944 the 100th Infantry saw its first action, and on 9 November relieved the 45th Division. The 100th Division was at that time a considerable distance from any of the old divisions, being located on the left flank of the 103rd Division, also new, which in turn was on the left flank of the 36th Division.

During the week of 24 November 1944 the 3rd Division was moved between the 100th and 103rd. The first week of December two regiments of the 100th Division attached ith elements of the 3rd Division, while one regiment was attached to a regiment of the 45th Division. About the middle of December the 100th Division was moved to the left flank of the 45th Division and was now between the 44th, a new division, and the 45th. This position was maintained throughout the winter and until the week of 9 March. Sporadic cases of hepatitis were reported in the 100th Division from 24 November until 26 January.

During the week of 26 January 1945, 14 cases of hepatitis occurred and the rate constantly increased from that time until 6 April. Judged by accepted incubation periods the source of the

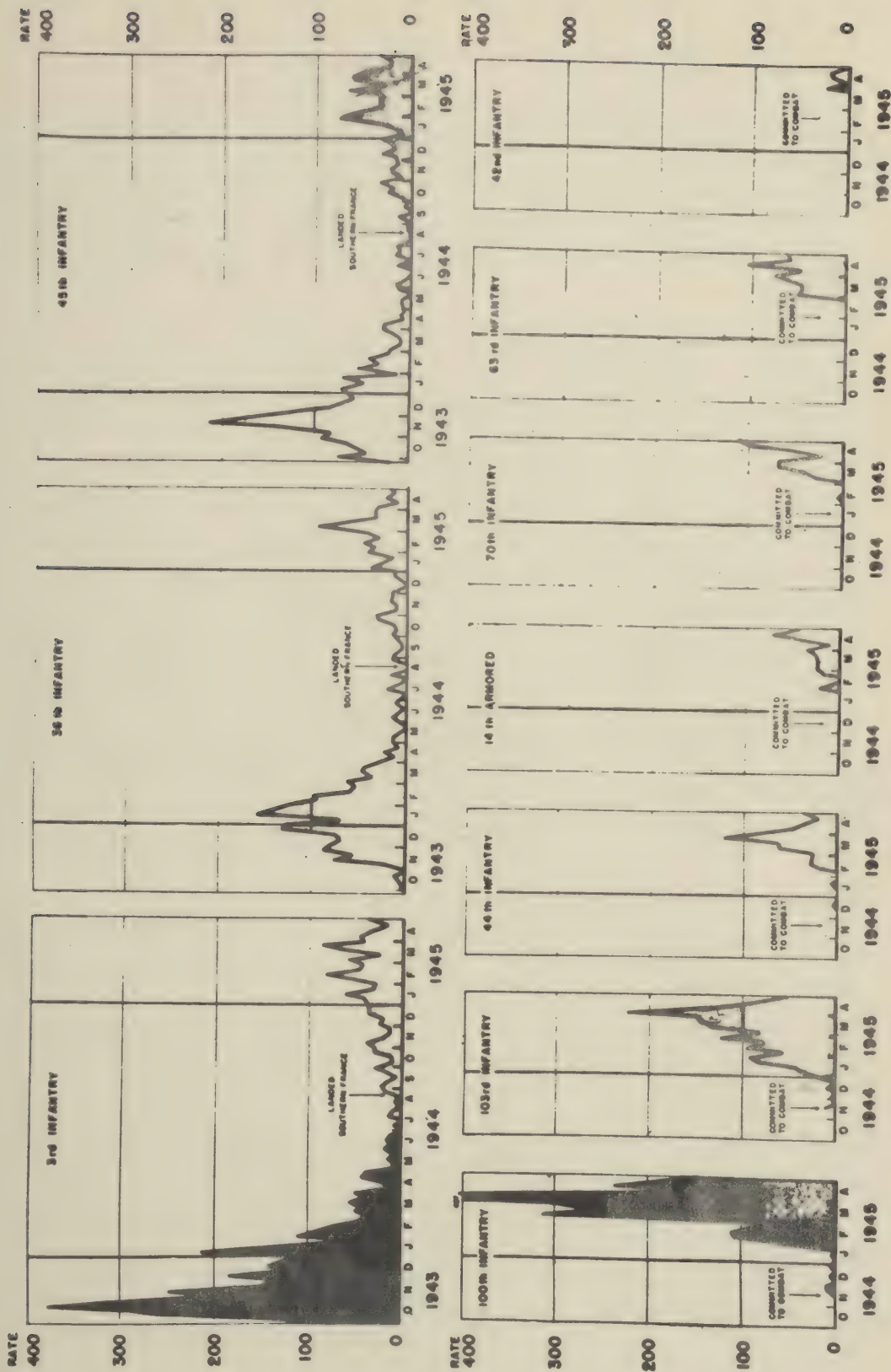


Figure 2.

Epidemic hepatitis in Divisions of the Seventh Army, European Theater of Operations, U.S. Army, rates per 1000 strength per annum, by weeks, 24 September 1943 to 27 April 1944, inclusive.

infection would appear to have been the 45th Division which at the time of contact was experiencing a rate of 21 per thousand per year. Contact with the Third Division had also been close.

The epidemic that followed was the most severe of any experienced by a unit of comparable size in the European Theater, with a maximum level of 437 per thousand per year for the week ending 23 March 1945. The epidemic lasted for several weeks. The last week in April, immediately prior to cessation of hostilities, the rate was still 146 and the epidemic had not spent its force by July 1945. (Table 7)

103rd Infantry Division.--Like the 100th Division, the 103rd Infantry Division entered the European Theater through the port of Marseilles in September of 1944. During the early part of its operations in the theater it was subjected to similar conditions in the south of France. There was little or no jaundice. The division was committed to combat during the week of 17 November, taking up a station between the 100th and 36th Divisions. It was thus located on the left flank of one of the old divisions. This position was maintained until the week of 8 December at which time the 45th Division was placed in the line on the left flank of the 103rd, putting the 103rd between two of the old divisions. During this time two regiments of the 103rd were almost constantly intermingled with two regiments of the 45th. The 103rd Division was then moved to the extreme left flank of the entire Seventh Army front, with its closest neighbor the 44th Division immediately to its right. This position was maintained until the week of 19 January, when the 103rd was again moved to the center of the line, on the right flank of the 45th and again very intimately associated with that division. This position was maintained until the 45th Division was relieved on 16 March.

As in the case of the 100th Division sporadic cases of hepatitis were reported from the first week the division went into the line, but cases did not appear in serious numbers until the week of 5 January which was four weeks after the division had been placed between two of the original divisions from the Mediterranean area. As will be seen from Figure 2, the rates for epidemic hepatitis increased very rapidly until the week of 6 April at which time the first decrease was registered.

44th Infantry Division.--The 44th Division came into the theater through Cherbourg, and was not exposed to any division or any troops previously in the Mediterranean area until committed to the Seventh Army. Jaundice had been practically unknown in the division. The unit went into action during the week of 17 November on the extreme left flank of the Seventh Army. Its nearest neighbor was the 100th Division, with little or no opportunity for exposure to any of the older divisions.

During the week of 1 December, the 157th Regiment of the 45th Division was attached to the 44th Division where it served with the 71st and 114th Regiments of that organization. During the week of 29 December the 103rd Division which had previously been with the 45th and 36th Divisions was deployed very close on the left flank of the 45th so that it was possible for members of the 44th Division to be exposed to soldiers of the 103rd during the time when the rate of the 103rd Division for epidemic hepatitis was increasing rapidly. For the week of 19 January the 103rd Division was moved again so that exposure of the 44th could only have taken place during the three-week period. During the week of 2 February elements of the 63rd Division were assigned to the left flank of the 44th and this position was maintained until the 44th Division was relieved during the week of 16 March. The first cases of hepatitis were reported in the 44th Division during the week of 9 February, six weeks after the 103rd had been deployed closely on its left flank. The epidemic that followed was relatively severe and extended over the course of many weeks.

42nd Infantry Division.--The 42nd Division was first committed to the Seventh Army during the week of 16 February 1945, at which time the 22nd Regiment of the Division was in the line with the 157th Regiment of the 45th Division. Thus the 42nd Division was deployed between the 100th and 103rd which were the first divisions to experience hepatitis among those not previously in Italy. Comparison of the attached tables will show that the 100th and 103rd Divisions were suffering an increased frequency in hepatitis at the time the 42nd Division was placed between them. The 42nd Division remained between the 100th and 103rd until the breakthrough at Saarguemines on 21 March. The first cases of hepatitis were reported from this division during the week of 30 March which is again six weeks after the first regiment could have possibly been exposed to older divisions.

The division first went into action in December 1944 under the Seventh Army on the right flank at Saarbrücken, serving as an emergency task force plugging gaps and weak points in the line. In January the Seventh Army was holding along the two-army front while the Third Army helped to fight back the Nazi bulge on the First Army front. The following month the Seventh Army was readied for renewal of attack and it was in this month the 42nd Division was announced as a part of the Seventh Army.

63rd Infantry Division.--The 63rd Division arrived in the ETO in December 1944. Some of the units saw action on 22 December 1944 but the Division was not committed as a unit until 8 February 1945. At this time the 63rd was announced as a division under the Seventh Army in Alsace.

Two regiments were committed during the week of 2 February on the left flank of the 44th Division. This is the week previous

to any cases of hepatitis being reported from the 44th Division. These two regiments attacked with elements of the 44th Division from this period until the week ending 2 March at which time the 63rd Division moved somewhat further to the left. At the same time the two regiments of the 63rd were attached to the 44th Division. One regiment of the 63rd was attached to the 3rd Division and remained with this Division for a period of three weeks, after which it migrated to the 100th Division and the 44th Division before rejoining the other two regiments to form an entire division.

Only one regiment of this division was ever exposed to elements of the 3rd, 45th or 36th Divisions but all regiments were closely allied to the 44th Division during the time that the 44th Division rates were increasing. The first cases of hepatitis were reported from this division during the week of 2 March which is five weeks after its first commitment in the Seventh Army.

70th Infantry Division.--The 70th Infantry Division arrived in the theater in December 1944, and reached the Seventh Army area in the latter days of that month. It was first committed during the week of 19 January at which time one regiment was attached to the 45th Division. During the next two weeks the other two regiments were not committed but were in an assembly area close to the 63rd Division. During the week of 9 February the regiment which had previously been attached to the 45th Division was attached to the 63rd Division and fought between two of its regiments. The following week the entire 70th Division was committed on the left flank of the 63rd Division where it remained until the breakthrough on 21 March at which time both the 63rd and 70th were taken out of the line. The first cases of hepatitis reported in the 70th Division were during the week of 2 March, six weeks after one regiment had been attached to the 45th Division and five weeks after the remaining two regiments had been in an assembly area close to the headquarters of the 44th Division.

14th Armored Division.--The Division came overseas in October 1944 and spent three weeks in rear areas of the Seventh Army during which time it was impossible to estimate contacts with epidemic hepatitis. Elements of the 14th Armored were first committed during the week of 15 December at which time the division was assigned to support the 103rd and 79th Divisions and had battalions attached to both of the above infantry divisions. This position was maintained for two weeks at which time the entire 14th Armored Division was withdrawn from the line and was not committed again until the week of 19 January, when it was in close support of the 100th Division. This position was maintained for two weeks, after which the division was again shifted and was in very close support of the 36th Division and in less close support of the 79th and 101st Airborne Divisions. During the week of 23 March the 36th Division was withdrawn from the line and the 14th

Armored attacked on the right flank of the 103rd Infantry Division. The 36th then came in the line to support and for the next two weeks the 14th Armored had elements closely intermingled with both the 36th and 103rd Divisions. This position was maintained until the breakthrough at which time the 14th Armored was far in advance of any infantry division. The first cases of hepatitis in this division were reported during the week of 2 February, six weeks after the division had first been put in support of the 103rd Division.

The repeated appearance of jaundice in susceptible divisions with no previous history of the disease rather promptly after the accepted incubation time, and following contact with divisions suffering with the disease, speaks strongly for a contact type of spread. Outbreaks of jaundice did not occur under circumstances of combat messing, incidence of diarrheal disease and insect distribution which were much the same, when contact was with army units where jaundice was not a particular problem.

Mode of Transmission

A mass of evidence has accumulated, although not readily available in any single source, to indicate that the usual method of transmission of epidemic hepatitis is by secretions of the upper respiratory tract. The behavior of the disease in 1945 in the Seventh Army would suggest that route as the usual method.

Epidemic hepatitis has been transmitted experimentally by the gastrointestinal route as well as by the respiratory tract, and the epidemiologic evidence from some outbreaks would support that means of transmission despite the weight of evidence being for a respiratory mechanism. Much stress is often placed on the association of outbreaks of epidemic hepatitis and of diarrhea and dysentery in military practice, without sufficient regard for the chance frequency with which both may occur in a unit at a given time. The most important consideration is perhaps the epidemiologic pattern of the two conditions, in that diarrhea and dysentery epidemics tend to be of abrupt onset involve many men and are relatively short lived, while those of epidemic hepatitis extend for months and sometimes two or three years unlike the epidemiologic behavior of diseases spread by the way of the intestinal tract.

The epidemic in the United States Army in 1945 was primarily among the field forces at a time when existing rates for intestinal disease were particularly favorable and when opportunity for transmission of disease by intestinal means was limited by the conditions under which men were living. Messing was more an individual than a community matter.

The suggestion that epidemic hepatitis may be insect borne has received little support. No particular insect has ever been

specially involved nor has the disease been transmitted experimentally through the agency of arthropods. The broad extent of the disease in most countries of the world and in all sorts of climates and environment would appear of itself to eliminate that consideration. The seasonal distribution with the principal incidence in winter and early spring would also discount the likelihood of that mode of transmission. The observation of a number of surgeons of field units are submitted as they bear on the general epidemiologic behavior of the disease and on the mode of transmission.

105th Infantry Division.--It is interesting to note that in not a single unit of the division did the rates for epidemic hepatitis bear any resemblance to the rates for the diarrheas and dysenteries. In the epidemic of acute diarrhea of 15 December to 1 January all units of the division were affected in proportionately equal extent. The epidemic of hepatitis did not affect all units proportionately and indeed the curve of this disease bore a striking similarity to the curve of upper respiratory disease in all units. Numerous reinforcements not subjected to the epidemic of diarrhea developed hepatitis. The consensus of opinion of medical officers of the division was that hepatitis is a contact disease of upper respiratory origin.

9th Evacuation Hospital.--Infectious hepatitis, which gained epidemic proportions in this command during January and February apparently subsided as quickly as it started for no new or recurrent cases occurred during March 1945. The frequency with which the onset was preceded by a sharp attack of diarrhea indicated that the portal of entry was most often through the gastrointestinal tract. However, occasional cases began with initial symptoms of a mild upper respiratory infection. Whether or not this might be an alternate portal of entry was a matter of conjecture. The command was not exposed to mosquito or other insect bites, and an insect vector was definitely excluded.

6th Armored Division.--The 48 patients evacuated to hospital during March 1945 with mild hepatitis of undetermined origin usually developed the illness subsequent to a mild or a moderate upper respiratory infection.

104th Infantry Division.--The 104th Infantry Division had 56 cases of jaundice between 5 January and 16 February. Ten occurred in the 413th Infantry Regiment, 32 in the 414th and 11 in the 415th Infantry Regiment with the remainder in three attached units. The cases occurred sporadically, both in respect to time and to units involved. No more than four cases were noted in any one day and no more than seven cases in any one company. At about the same time three similar cases are known to have occurred among VII Corps troops and six cases in another nearby division, although complete reports for other units were not available due to changes in corps jurisdiction.

There had been no concomitant rise in the general rate of respiratory or digestive disturbances; on the contrary and since December 1944, there had been a definite increase in both rates. The division had occupied the same general area for many months, although various units of the division had rotated within the area at various times. Spread by way of the respiratory tract was deemed most nearly compatible with the epidemiological facts. The distribution of cases by units and by time for the 104th Infantry Division, Table 8, illustrates the characteristic behavior of epidemic hepatitis in Ground Force units.

26th Infantry Division.—The rate per thousand per annum of epidemic hepatitis for the 26th Infantry Division for the week ending 2 March 1945 was 137.9. One hundred eight cases with icterus had been reported since 2 February 1945, with the distribution by weeks ending 9 February, 8 cases; 16 February, 9 cases; 23 February, 27 cases; 2 March, 42 cases; and during the 4-day period ending 7 March, 22 cases. Of the 108 cases hospitalized for observation and study, approximately one-half had an onset associated with upper respiratory prodromata, while the other half had gastrointestinal prodromata with not infrequent association of the two. The onset of the current epidemic of hepatitis followed by 6 to 8 weeks an upswing in the frequency of respiratory diseases within the division. Cases of hepatitis were not confined to any single organization, and the majority were among headquarters personnel of the various divisional units. Infections were mild and patients returned to duty in two to three weeks.

A common causative factor or a direct link between cases was rarely determined. When Company M of the 101st Infantry Regiment reported six cases of epidemic hepatitis in February 1945, inquiry brought information of a single original infection in that unit on 25 January 1945. A physical inspection of all men of the unit after appearance of the six cases showed five other men to have ambulant disease not previously reported at sick call.

AAF Station 120.—Ten patients with jaundice were treated during the six weeks preceding 1 March 1945. Infection was believed to have arisen within the unit, as few cases had been reported in surrounding towns. Prodromal symptoms were uniformly those of a severe nasopharyngitis preceding the appearance of jaundice.

27th Evacuation Hospital.—Numerous patients were seen at the 27th Evacuation Hospital in which a diagnosis of epidemic hepatitis without jaundice was warranted. For the most part they had some degree of anorexia, vomiting, abdominal cramps, tenderness over the right upper quadrant usually more marked to the right of the mid-line and in the upper gastric area, and a palpable liver. The illness was usually of sufficient degree to require evacuation to a General Hospital.

86th Chemical Battalion.--Thirteen men of the 86th Chemical Battalion developed jaundice during the week of 12 February 1945. Three patients admitted to hospital on February 8, 9 and 10 had previously been in hospital for acute upper respiratory infection between February 1 and 3. They were discharged as the symptoms cleared, only to be readmitted several days later when jaundice became evident. This succession of symptoms was characteristic of patients from the respiratory symptoms suggest the respiratory tract as the portal of entry.

463rd AA (AW) Battalion.--During a period of nine days, 15 cases of jaundice appeared in the 463rd AA (AW) Battalion attached to the 79th Infantry Division. The first case was on 22 July, another on 23 July and several in succeeding days, with the last two on 29 July and on 30 July. The patients were from the various batteries of the unit, which were separated tactically and not in contact with each other.

Communicability Among Hospital Employees

A survey of acute epidemic hepatitis among hospital personnel engaged in the care of patients with the disease gave information on 31 hospital units of which personnel exposed to risk of contracting the disease included 205 medical officers, 564 nurses and 849 enlisted men. The duration of exposure incident to the care of patients with hepatitis was from one day to two years but in most instances was less than two months.

Personnel contracting epidemic hepatitis included four medical officers, 23 nurses and 22 enlisted men, to give attack rates of 2% for medical officers, 4% for nurses and 2.6% for enlisted men.

Control Measures

Since the mode of transmission of epidemic hepatitis remained undetermined, Army Regulations directed that the general measures against intestinal, respiratory and insect-borne diseases were to be employed. Principal stress in the European Theater was placed on the procedures designed for control of infections transmitted by secretions of the upper respiratory tract. Judged by the progress of the disease in most units attacked, little result was derived from any of the measures employed.

POST-ARSPHENAMINE JAUNDICE

This third general problem among acute diseases associated with jaundice was of no great moment in the European Theater. The substitution of penicillin for the previous regimen of the arsphenamines served to eliminate interest in the jaundice that developed

among patients under treatment for syphilis, despite its continuing infrequent occurrence.

The cause of the jaundice among patients under treatment for syphilis is open to a variety of interpretations. Toxic action of the arsenicals is a ready explanation but the dominant opinion has developed that in most instances the disease follows ordinary exposure to epidemic hepatitis. The frequency of such instances is observed to be greatest when the epidemic disease is prevalent. That the action of the arsenicals on the liver may exert a contributing influence appears reasonable.

EPIDEMIOLOGIC CASE REPORT NO. 2 - A soldier receiving anti-luetic treatment for primary syphilis developed jaundice of a non-obstructive type in February 1945. The icteric index was 30. In the course of treatment up to the time jaundice appeared he had received 1.47 grams of mapharsen. Epidemic hepatitis was epidemic at the time.

The outstanding contribution on pathogenesis of the condition arising from experience of the war was the demonstration in British experience of transmission of jaundice by contaminated syringes. A number of clinics commonly used a single syringe in the treatment of a number of patients and it developed that enough blood entered a syringe in the course of intravenous injections to serve as a medium for the transmission of jaundice.

Post-arsphenamine jaundice in the recent military experience in England was seemingly more frequent in British than in American practice. Such infections would appear in part to have been representative of homologous serum jaundice with the mechanism of infection through syringes; and in part, and perhaps most commonly, to usual infection with the agent of epidemic hepatitis. Added susceptibility to infection as a result of action of the arsphenamines is probable but unproved. That any great proportion of cases of jaundice in this group was directly and solely due to toxic effects seems unlikely.

HOMOLOGOUS SERUM JAUNDICE

The epidemic of homologous serum jaundice following the administration of yellow fever vaccine was the most outstanding event of its kind in the European Theater. Isolated instances of this form of infective jaundice occurred throughout the period of operations, largely due to the effect of transfusion of blood or blood products, but the 1942 experience was the single outspoken epidemic. It was part of a general phenomenon involving troops of the United States Army stationed in many parts of the world, a fact unknown at the time the first cases were encountered in Europe. The problem was that of an unfamiliar disease and a completely unknown kind of epidemic. The methods of study that were employed and the epidemiologic attack were on that basis.

The first information that jaundice had occurred on board American troop ships came through a message from the Department of Health for Scotland on 13 May 1942, advising that 26 patients with jaundice were included among a large complement of troops just arrived in Glasgow. On the assumption that the disease was probably infectious but not epidemic, the patients had been permitted by the Scottish health authorities to proceed to their destination in Northern Ireland.

Field investigations in the Northern Ireland area were undertaken 20 May 1942 by members of the American Red Cross-Harvard Field Hospital Unit. Practically all of the patients with jaundice had been admitted to the 5th General Hospital, then stationed near Belfast. It was immediately apparent that the outbreak was of more serious proportions than originally reported, since 83 patients with jaundice had by that time been admitted to the hospital wards. This of itself was unprecedented.

Outbreaks of ordinary epidemic hepatitis are characterized by a slow and orderly development of the epidemic process, with the result that the number of patients at any one time is relatively few even in the course of an extensive outbreak. A ward of 83 patients with manifestations of acute jaundice was beyond any ordinary clinical or epidemiological experience.

Ward rounds were promptly made with the purpose of determining the general clinical nature of the condition at hand. General inquiry brought evidence that the disease was prevalent among American troops, that the outbreak had started in America, that numerous infections had developed aboard ship, and that subsequent to arrival a great many more had been determined. Although the presence of an excessive frequency of jaundice in America was unknown to military authorities in the British Isles, it soon became evident from conversation with physicians accompanying the newly arrived troops that jaundice had been decidedly prevalent within recent months among the United States armed forces in America. Definite information about rates was not obtained nor was information available about deaths, although individuals knew of three and sometimes five fatal cases.

Clinical observation of patients then in hospital did not serve to determine the nature of the existing condition. It was certainly not Weil's disease. The signs and symptoms were compatible with the usual behavior of epidemic hepatitis. The condition could conceivably have been the result of infection by modified yellow fever virus, but if so it was certainly a most atypical yellow fever. Laboratory and field studies were evidently needed to supplement the primary clinical observations.

Description of the Area.--About 20,000 men arrived in North Ireland after having transshipped from Glasgow on 13 May

1942. They were housed in a variety of cantonments in the south and east of North Ireland, the forces being distributed in groups varying from 500 to 1,000 men.

One of the principal units came originally from Fort Knox, Kentucky. The troops proceeded from there to Camp Dix, New Jersey and embarked for the European Theater at the port of New York. Jaundice had first made its appearance at Fort Knox about the middle of March. More cases occurred at Camp Dix in late April and during their days at sea from April 30 to May 14 still more had been reported. The patients belonged for the most part to the 1st Armored Division.

The second group came from Fort Sheridan, Illinois, travelled from there to Indiantown Gap, Pennsylvania, and subsequently reported to Camp Dix where they embarked in the same convoy with the first group. Jaundice did not appear in the second group until about the tenth day at sea which was about 15 days after contact with troops of the first group where jaundice was already present.

That the second group was infected by the first did not appear likely, because the accepted incubation period of epidemic hepatitis is about 30 days. Furthermore, essentially all members of both groups had been inoculated against yellow fever. Those of the Camp Knox group received the vaccine in the early days of January while the Camp Sheridan group were inoculated about the middle of March. If a connection existed between the vaccine and the development of jaundice, then both groups had developed the condition about two months subsequent to its administration.

In the days immediately following debarkation many new cases appeared in both groups. The epidemic passed its peak at the end of May but nevertheless continued with scattered cases through June.

Field Studies.—The decided clinical variation among patients seen in hospital and the presence of many mild infections led to the assumption that subclinical disease was probably common. Furthermore interviews with ship and camp surgeons made it evident that in all probability many more cases of jaundice existed among the troops than was indicated by the number of patients referred to hospital. Field surveys were undertaken in order to determine the actual prevalence of the disease and to ascertain the general level of severity in the military population at large. Forms were prepared which incorporated questions concerning the principal clinical features of the disease; whether the onset had been in America, on board ship or in Ireland; identification data; and space for recording the results of physical examinations. The men examined were placed in one of four categories: patients with jaundice sent to hospital,

patients with jaundice not hospitalized and noted as ambulant, persons with subclinical jaundice, and those not affected.

Five different military organizations, each of about 150 men and known to have suffered recently from epidemic jaundice were surveyed within the period 23 May to 26 May 1942. The actual groups were selected by the division surgeon and were stated to include one group with a relatively high incidence of jaundice, another that had relatively little jaundice, and three thought to be about general average.

The incidence of jaundice in the several commands studied varied from 10 per cent to 39 per cent of total strength. A control group with a history of freedom from jaundice within recent months gave no indication of the presence of the disease, except for one individual with questionable subclinical jaundice.

The ratio of ambulant cases to hospital patients within the same organization was in the proportion of about four to one, so that an estimate of total cases for the whole command on the basis of 250 patients in hospital was about 1250.

Correlation was next determined between the lot number of the yellow fever vaccine and the presence or absence of jaundice. In summary, jaundice was not associated with the administration of all lots of vaccine. In some instances the number of patients related to a given lot was so small as to justify no conclusions. Some 32 persons had not been vaccinated against yellow fever and none had jaundice. The majority of patients with jaundice had been inoculated with yellow fever vaccine from Lots Nos. 338, 351, and 368 and they had a relatively high attack rate of jaundice. Other sizeable groups of persons received yellow fever vaccine from lots such as No. 327, 340 and 423 and no individual within these groups had become ill.

The attack rates in the three large groups that received vaccine of Lot Numbers 338, 351, and 368 were respectively 33%, 18% and 14%. This variation conceivably might be either a function of the vaccine itself or these groups may have been subjected to circumstances favorable to the spread of an epidemic agent having an origin independent of the vaccine itself. If the latter were true, then a variable attack rate would be expected among different groups of men receiving the same lot of yellow fever vaccine. The best proof that the attack rate was a function of certain lots of vaccine was in respect to Lot Number 368, which had been administered to at least three groups of men represented in the study. Virtually similar attack rates for jaundice were observed in all three instances.

In summary, certain lots of vaccine were associated with a higher attack rate for jaundice than others. There was indication that for one lot, Number 368, the attack rate was the same when given

to three different groups of persons having little or no contact with each other.

Experimental Studies

A number of studies were undertaken at the laboratories of the Wellcome Research Institution in London through the interest and cooperation of the institution staff.

Attempts were made to isolate a filtrable virus from the blood of patients by inoculation of monkeys and mice. Suspended cell cultures of chick embryo tissue and tyrode solution were inoculated with serum and clot suspensions. Developing chick embryos were inoculated with serum and clot suspension. The result of these experiments was essentially negative in that neither yellow fever virus nor any other infectious agent was isolated from the material.

The serum of 25 patients were tested for yellow fever neutralizing antibodies by the intraperitoneal mouse protection test using six week old Swiss mice. Serums from English soldiers inoculated with yellow fever vaccine during the past year were used as controls. There was no significant difference in the neutralizing power of the serums of the men of the two groups. The inoculation of animals with tissues from a fatal human case was completely negative. Inoculation of ferrets with duodenal fluid from infected patients was likewise without result.

Source of Infection

Practically the whole military population concerned in the outbreak had been vaccinated recently against yellow fever. The vaccine contained no yellow fever immune serum but was made from a seed virus propagated in tissue culture using a medium which contained a small amount of normal human serum. The virus used had undergone long artificial culture and was so greatly attenuated that partial neutralization with immune serum was no longer practiced nor deemed necessary. Five possible theories by which the disease might have developed were hypothesized.

The yellow fever virus in the vaccine was a living virus known to have been greatly attenuated, but always with the potentiality of acquiring enhanced pathogenic properties. Such an occurrence could conceivably have led to a mild disease associated with jaundice, distinct from classical yellow fever.

The prevalent jaundice might have been due to the hypothetical virus of ordinary epidemic hepatitis incorporated in the seed virus by way of the supposedly normal human serum used in its propagation, despite the usual precaution of inactivation. The second virus - of epidemic hepatitis - would then be carried along

with the yellow fever virus in tissue culture. If this was the case, successive lots of yellow fever vaccine prepared over a given period would expectedly be contaminated with the agent of epidemic hepatitis and virtually all would lead to cases of jaundice when administered to susceptible persons.

In the preparation of the vaccine, chick embryo tissue containing the attenuated yellow fever virus was diluted with normal inactivated human serum in the proportion of one part embryo tissue to nine parts of serum. Some of the supposedly normal human serum used as a diluent might have come from a patient or a person having an early or subclinical infection of epidemic hepatitis or which an independent virus of similar nature, thus contaminating the particular lot or lots of vaccine in which it was used. In this instance some lots of vaccine would be expected to produce jaundice and others would not, since probably not all pools of diluting serum would be involved.

The epidemic of jaundice might be due to a fortuitous circumstance whereby epidemic hepatitis appeared among the population recently vaccinated against yellow fever, the epidemic having no relation to the vaccine itself.

The disease could be of purely toxic origin due to a chemical poisoning and bearing no relation to an infectious agent.

That the condition was of toxic origin was doubtful. There was no evidence that food or other environmental factors had intruded at this time. Moreover the apparently long incubation period in the disorder was against a chemical poisoning. There was no presumption of a poisonous chemical fraction in the vaccine.

That the outbreak was simply coincidental with the vaccination for yellow fever was doubtful.

There was no evidence that epidemic hepatitis existed in appreciable numbers in the particular geographic areas from which these troops came in America. Epidemic hepatitis furthermore had been a relatively rare infection in the United States since 1922. Moreover the epidemiological curve lacked the periodic monthly aggregation of cases, so typical of spontaneous outbreaks of epidemic hepatitis. The average attack rate of the spontaneous disease was about 7 per cent compared with the observed rate of 21.9 per cent among the four major groups of the present outbreak.

Clinically, the existing disease was not suggestive of yellow fever even in its mildest conceivable form. Urinary changes were largely absent, as were hemorrhage and cardiac involvement.

There was no evidence of chemical poisoning.

Behavior of the outbreak epidemiologically was not like that of ordinary epidemic hepatitis of spontaneous origin. The seasonal distribution was wholly different, the incubation period was much longer.

On the available evidence the cause would seem to lie within the vaccine. The long period over which some lots of vaccine had been known to produce jaundice would suggest contamination of the seed virus with a jaundice producing agent. More information was needed about the constitution and size of the pools of normal serum used for dilution.

Further field studies were projected to develop knowledge about the regularity with which certain lots were involved and whether or not they occurred in series, irregularly, or if all vaccine lots were concerned. The jaundice producing agent would seem to have been added to the vaccine through normal human serum used in its preparation, but whether through culture mediums used in cultivation of seed virus or through serum diluents could probably be decided by field studies of the types projected.

The long incubation period in this outbreak was not explained. Ordinarily the incubation period for epidemic hepatitis is 30 days. In this instance it was commonly 3 to 4 months or longer. This suggested the presence of another filtrable virus distinct from that of ordinary epidemic hepatitis. The long incubation period was a regular occurrence in jaundice after immunization processes, both active immunization as related to yellow fever protection in past experience, and with passive immunization against measles and more recently with mumps. Jaundice after immunization appeared furthermore to be less communicable than ordinary epidemic hepatitis. No spontaneous outbreaks with such a long incubation period had ever been noted.

Program of Study

It appeared that the working quarantine which had been put into effect on arrival of these troops could be raised with safety and certainly after a month had elapsed since their arrival.

Plans were made for the collection of data on the prevalence of jaundice in all units of the command, to be correlated with the lot number of the vaccine used. Additional surveys were proposed for troops who had received the lots of vaccine associated with high attack rates for jaundice, especially Lot Number 338. Because of the extent of liver damage determined by clinical studies of the 5th General Hospital, an adequate program of convalescence was recommended. Periodic survey of affected individuals was believed essential to determine residual permanent liver damage.

The results that came from these proposed clinical, field and laboratory observations constitute the balance of this report. The general features of the clinical disease will be first discussed. This will be followed by a general presentation of the epidemic situation. The details of epidemiologic studies contributing to the solution of the problem follow thereafter.

The Clinical Disease

The clinical picture presented by the patients with inoculation hepatitis was remarkably stereotyped. The outstanding differences were of degree rather than kind. The onset of the disease was rarely abrupt but in the majority of cases could be accurately dated. Typically, it was marked by the development of gastrointestinal disturbances and the coincident appearance of dark urine. Thereafter the patients almost uniformly experienced a feeling of lassitude and became readily fatigued on exertion.

The most characteristic feature of the indigestion was a rather complete loss of appetite, or if the appetite was preserved, a few mouthfuls of food sufficed. In most instances the ingestion of food, especially beef, was followed by a burning gastric distress, nausea, and for about one-fourth of patients by vomiting. Constipation was common and likewise occurred in about one-fourth of cases.

Icterus usually appeared within two or three days after dark urine was first noted. The onset of systemic disturbances occasionally preceded the icterus by two or three weeks. During the first week or two, as the icterus became more intense and the symptoms developed in severity, the patients commonly experienced generalized aches and pains, muscular weakness, chilly sensations in the absence of fever, itching, photophobia, and epigastric or right upper quadrant pains on pressure or on movement of the trunk.

All but about 8 per cent of patients experienced indigestion in one form or another. A small number, less than 4 per cent, had no constitutional symptoms whatever throughout their illness. The severity of symptoms as might be anticipated was roughly proportional to the depth of icterus, its duration and the depression of liver function.

So far as physical signs were concerned, those most commonly encountered were icterus of the sclerae and skin, and a demonstrably enlarged and tender liver. A small percent of cases developed transient splenomegaly. Chemosis, conjunctivitis and occasionally petechiae were observed in association with marked icterus.

Clinical Course.--In the majority of cases jaundice deepened and symptoms became progressively more marked over a period of from one to three weeks before improvement set in. Symptomatic

improvement not infrequently preceded the maximum development of icterus. In most instances this improvement occurred coincidentally with hospitalization or shortly thereafter. Similarly symptomatic improvement was almost invariably well established some days or weeks before the jaundice had entirely cleared.

The height of the illness, defined as the period of maximum icterus, appeared to be somewhat dependent on the time of hospitalization with reference to the onset of the disease. Thus, of patients hospitalized within one week of the appearance of the initial symptoms, 80% began to improve within two weeks of the onset. Of patients hospitalized more than two weeks after their first symptoms, 30% experienced the height of their illness after the fourth week, as contrasted with 5% of the early hospitalized cases.

Jaundice disappeared within three weeks in about one-third of cases and within six weeks in over two-thirds. In a small number, approximately 4%, jaundice persisted for three months or longer. The depth of icterus appeared to reflect with reasonable preciseness the degree of liver damage, and held some prognostic significance with respect to the ensuing course of the disease, especially in regard to the anticipated duration of jaundice and depression of liver function.

Hepatomegaly was not demonstrable ordinarily until the second or third week of the disease, although the finding of upper right quadrant tenderness or tenderness on deep percussion over the liver area was the rule in the early stages. Liver enlargement eventually developed in over two-thirds of patients, although ordinarily not extending more than two finger-breadths. Hepatomegaly persisted for an average of 3 to 6 weeks and its disappearance in most instances was preceded by the disappearance of jaundice. The liver failed to enlarge in over half of the mildest cases, whereas hepatomegaly appeared in all but very few of the extremely icteric patients. In those with marked jaundice, failure of the liver to enlarge was associated with marked delay in recovery and the appearance of a large liver came to be regarded as a welcome sign. Liver enlargement beyond two finger-breadths was most commonly encountered in individuals whose icterus was particularly pronounced.

The spleen became demonstrably enlarged in 7% of cases. In almost all instances, splenomegaly was associated with liver enlargement and had no peculiar prognostic significance so far as severity or duration of the illness was concerned.

That prognosis of the disease was somewhat influenced by the age of the patient was suggested by the observation that approximately one-third of individuals over 40 years of age had severe hepatitis, on the basis of an icteric index over 100 and a

duration of jaundice exceeding three months. On the other hand, less than one-twentieth of patients under 40 ran comparable courses. There was nothing to indicate that patients presenting a past history of jaundice reacted in any unusual fashion to post-inoculation hepatitis.

Convalescence.--Convalescence for the hepatitis patient was a slow and arduous process more akin to convalescence from tuberculosis than other types of jaundice. A long duration with physical weakness and all its associated signs marked in many cases a stormy return to health without the patient ever being seriously ill. The eventual convalescent program emerged after early misconceptions of the duration of the disease. It was a rehabilitation program carefully outlined and supervised with progressive exercises arranged according to the clinical improvement and ability to undertake an increasing load of physical exertion. The response to this exercise program proved a most satisfactory method of determining disposition to duty or return to the Zone of the Interior.

Identity of the Disease.--On the basis of clinical observation, leptospiral jaundice was readily ruled out. The differential diagnosis between ordinary epidemic hepatitis, homologous serum jaundice and jaundice due to a chemical poison or toxin could not be established on a clinical basis alone.

The Course of the Epidemic

Infectious jaundice of all forms had been absent from records of the theater during the first few months of 1942. The onset of the epidemic was sharply defined and coincided with the arrival in the middle of May of about 20,000 troops in Northern Ireland. Many were jaundiced on debarkation. By the end of September 1942, which may be taken as the end of the epidemic, 1462 cases had been sent to hospital or quarters as determined from the official 86ab reports. Field surveys indicated that the actual number of cases was considerably greater since numerous patients with minimal signs and symptoms were treated on active duty, and many on the basis of adequate sampling were shown to have remained wholly unrecognized.

The admission rate for jaundice for the theater was 186 per thousand strength per annum for the month of May, and for the week ending 22 May 1942, it was 354. From this date, admissions declined until 18 September 1942, after which a level of approximately three per thousand persisted for the following 12 months. The greatest number of cases was reported for the week ending 22 May. The distribution by months through the course of the outbreak as shown by 86ab reports is presented in Table 1.

Geographic Distribution.--The epidemic was essentially one of the North Ireland area for the reason that most troops of the theater were stationed there at the time.

The only satisfactory information on the number and distribution of patients included within the outbreak comes from a series of individual and special field surveys made at the time. Infectious jaundice was not reported on the Statistical Health Report until 22 May 1942. In some instances, cases of the disease were entered on that part of the form provided for special conditions, but in general reporting before the date mentioned was unsatisfactory. Subsequently, many duplications were encountered. It was found necessary to make surveys and obtain data directly from the individual units concerned and the computation which is presented in Figure 3, Table 9 is derived from that source. The responsibility for these studies rested with special investigators of the Division of Preventive Medicine. If the end of the outbreak be accepted as the month of September, the number of cases of infectious hepatitis from the beginning of activities in the theater in late January through the week of 25 September 1942 is 1915 as determined by these special studies. The number of cases that occurred in North Ireland was 1591 and 324 were noted for Great Britain. Because of the great differences in military strength in the two areas, the rates were essentially the same. Cases noted within a given week are by day of onset of the disease and not day of report, as is true of the series of 86ab reports included in Table 1.

Enough information is available to assure that not all cases were representative of homologous serum jaundice, since a basic residuum of ordinary epidemic hepatitis occurred in both areas. The latter number cannot be determined with preciseness but a satisfactory idea can be obtained by comparison with the endemic prevalence which persisted after termination of cases due to administration of yellow fever vaccine.

While Iceland was a part of the European Theater of Operations, medical problems of that area were never an intimate feature of the work of the theater. Reports on the incidence of disease were sent directly to the Office of The Surgeon General in Washington. The summary of the epidemic of jaundice presented in this discussion excludes Iceland and relates only to cases which occurred in the United Kingdom.

Information became available to indicate that the condition was as prevalent in Iceland as it was in the United Kingdom. As of 1 September 1942, 1320 patients with jaundice were known to have been hospitalized and about 200 more had not been sent to hospital. With a few exceptions the cases were mild and no fatalities occurred. Most instances of the disease were among troops of echelons arriving in Iceland in March and April, and most of the troops had been immunized against yellow fever in February 1942, with yellow fever vaccine of Lot No. 368. The exception included one patient who received Lot No. 367, one of No. 353, one 350, and eleven who had been immunized with Lot No. 369. The 11th Infantry Regiment and the

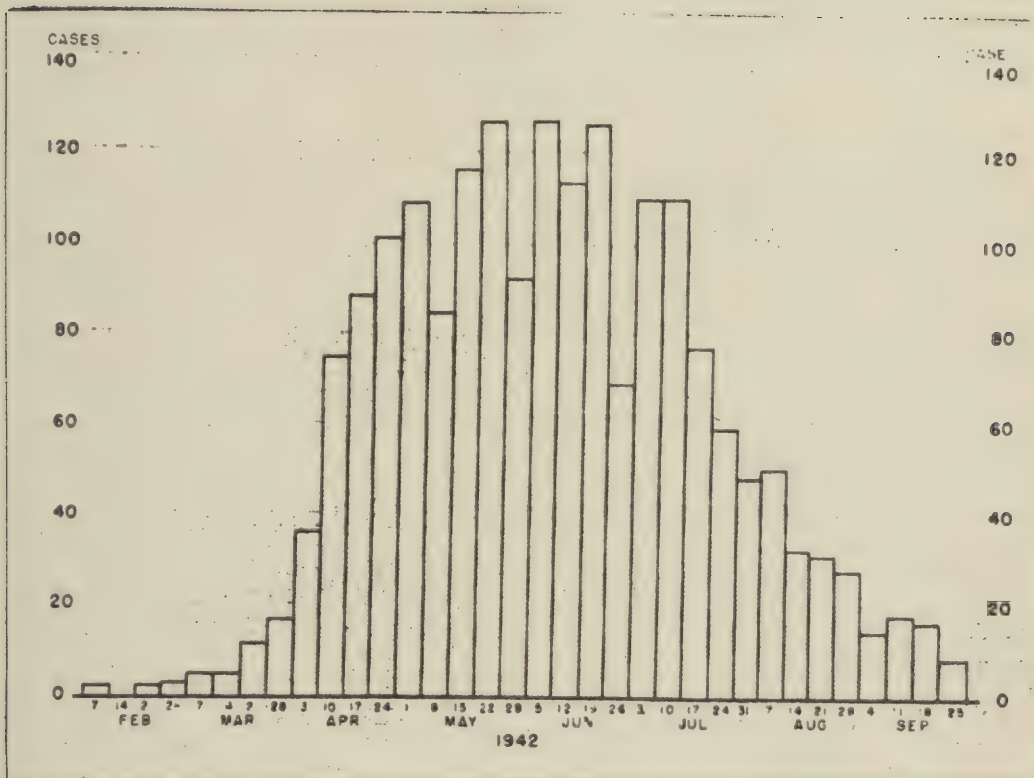


Figure 3.

Homologous serum jaundice of origin from yellow fever vaccine, cases by week of onset, special study survey, February to September 1942.

2nd Infantry Regiment were the units with the greatest number of patients, having 636 and 140 infections respectively. The remaining cases had occurred in other divisional units and a few among non-division troops.

Mortality in the European Theater

Two of the 1915 patients died of homologous serum jaundice, to give a case fatality rate of 0.1%, a rate which is lower than that ordinarily experienced with epidemic hepatitis. It was less than the general rate for the army as a whole in respect to cases following administration of yellow fever vaccine.

The first patient died in the first week of illness. The clinical course had been progressively retrogressive with deepening jaundice. There was never any liver or splenic enlargement and death was preceded by coma. Post mortem examination showed red atrophy with atypical regeneration and severe icterus with widespread small hemorrhagic changes through most of the organs. The liver was small, 935 grams, with raised irregular nodules up to 0.5 cm in diameter over the right lobe. The left lobe was small, finely wrinkled and the cut surface was purplish red in color. Microscopic examination of the right lobe showed zones of varying size in which liver cells were entirely absent, with only stroma, vessels and bile ducts remaining. Irregular patches of liver cells surrounding central veins and without identifiable central vessels were present and represented islets of regeneration. The left lobe showed complete destruction of all liver cells, with only slight proliferation of bile ducts in portal zones. Other organs were essentially normal, both grossly and microscopically. This single death among cases in North Ireland occurred 5 June 1942.

The second fatal case was that of a member of the Air Forces stationed in Great Britain. The onset of illness was on 10 August 1942, and death occurred on 12 September 1942. The liver was very small and the capsule was wrinkled. Large nodular areas were present, having a firmer consistency than the rest of the liver. The liver surface was bright yellow on surfaces made by cutting, and mottled with fine red dots. The bile ducts were very prominent, the liver substance considerably firmer than normal liver and generally fibrous.

A third patient apparently recovering from hepatitis died of miliary tuberculosis in the fourteenth week of icterus, 13 October 1942. The gross pathological examination also showed red atrophy with regeneration of the liver, similar but more extensive than that of the first case noted. The microscopic changes were less pronounced than in the other cases. All lobes of the liver were similarly affected and miliary tubercles were superimposed on the basic changes due to hepatitis. Other organs of the body

presented only the pathologic changes of tuberculosis, with no organ free from miliary tubercles.

Incidence of Jaundice by Lot Number of Yellow Fever Vaccine

Data were obtained for all troops of the North Ireland Command in respect to the number of cases of jaundice that had occurred in each military organization, according to the lot number of yellow fever vaccine administered. The field investigation form required the listing of each lot of yellow fever vaccine used in protection of the organization; the number of men who received each particular lot; the number according to lot number who developed jaundice, this information being subdivided into those patients who were sent to hospital and those who remained ambulant; and finally special attention and information about men of the various commands who did not receive yellow fever vaccine and the frequency of jaundice among them. Information was obtained for the period dating from the first immunization against yellow fever in the particular organization and extending through 31 May 1942.

Scatter of Lot Numbers.--Information was sought from these data on whether or not jaundice occurred more or less regularly over a given period of time and through a continuous series of lot numbers. In the event that this were true, it would indicate that the seed virus used in preparation of the vaccine was most likely involved. This might conceivably be the yellow fever virus itself or an extraneously introduced virus.

On the other hand, if groupings of certain lot numbers could be determined in respect to the occurrence of jaundice, with intermediate lot numbers uninvolved, such evidence would indicate that the trouble more likely was in relation to the serum diluent rather than to the seed virus itself.

If an indiscriminate scatter were observed, attention would necessarily be attracted to factors of contact with outside sources of infection, or to some other origin in explanation of the outbreak. (Table 10).

Inspection of the data shows four rather well defined groups. Included in the first group are Lot Numbers 317 to 320 inclusive. The second group includes Lot Numbers 333 to 338; and the third includes only a single lot of vaccine, No. 351; while the fourth grouping is of two lots, Numbers 367 and 368. These groupings of certain lots of yellow fever vaccine whose administration was associated with a definite frequency of jaundice, and the existence of intermediate lots where no jaundice occurred, suggested strongly the activity of the serum diluent used in preparation of certain lots of vaccine as the probable source of infection.

Lot Numbers of Vaccine Associated with Jaundice.--The data of the preceding table, augmented by information from subsequent field investigations, identified all lot numbers of yellow fever vaccine used in inoculation of troops where jaundice later appeared. Among all of the troops here concerned, 93 different lots of vaccine were employed and 19 were associated with the occurrence of jaundice; in the proportion of 20%. The lot numbers involved and the attack rates per hundred, are presented in Table 11.

A high correlation is shown between the incidence of jaundice and the administration of certain lot numbers of yellow fever vaccine. A great proportion of cases were associated with two particular lots, No. 338 and No. 368. A significantly high rate was associated with certain others, which include Lot Numbers 319, 333, 335, 351 and 367.

Only a few scattered cases of jaundice were related to other lot numbers and the significance of these occurrences has yet to be determined. In the first place, too few persons were involved in respect to at least two lots to warrant any evaluation, these being Numbers 308 and 334. Secondly, the number of cases of jaundice associated with certain others was so small as to suggest accidental infection from some other source or a questionable diagnosis of the cases involved. This applies especially to Lot Numbers 346, 353 and to the large group in which the lot number is unknown.

Finally, three other lot numbers, Nos. 317, 320 and 330, while involving a relatively limited number of persons, nevertheless fall into a series which has been heavily involved, as noted in the preceding section. The relationship of these lots may or may not be significant.

The table lists all lot numbers with which jaundice was associated and for each the number of persons inoculated, the number of cases of jaundice and the number of those hospitalized, and the attack rate per one hundred persons. The lots without associated jaundice are lumped together under the heading of others. The individual attack rate for lots associated with more than one or two cases varies from 2.1 to 13.6 per hundred, while the similar rates for the entire group (936 cases out of 31,551 individuals inoculated) is 3.1. Approximately three-fourths of the patients were hospitalized.

A field survey of the 814th Engineer Battalion showed this organization which was stationed in England to have received for the most part different yellow fever vaccine lots from the troops in Northern Ireland. The lots associated with jaundice in that battalion and not included in the above large series were as follows: Table 12.

In addition to the 31,551 persons receiving yellow fever vaccine, data were also obtained on 4,073 soldiers who were not inoculated. Among this group were 13 cases of jaundice (0.3 per one hundred). A detailed investigation of 8 of the cases is subsequently described.

The conclusion to be drawn is that the well defined grouping of certain lot numbers suggests the serum diluent as the factor through which the unknown virus was introduced into the yellow fever vaccine.

Clinical Reaction According to Lot Number.---Correlation was also made between the lot number of the yellow fever vaccine received by individuals, the presence or absence of jaundice, and the extent to which jaundice was present.

Of 1594 persons surveyed, 1531 had received yellow fever vaccine from one or other of 21 different lots including 238 persons for whom the lot number was unknown. Some 48 persons had not been vaccinated against yellow fever and records were lacking for 15. The majority had been inoculated with vaccine from Lot Nos. 338, 351 and 368. Groups inoculated from these lots had a relatively high attack rate of jaundice. Other sizeable groups of persons received yellow fever vaccine from Lots No. 327, 340, 347, 353 and 423 and no individual within these groups became ill. Again five cases of jaundice occurred among nine persons inoculated with Lot No. 317 and 15 cases occurred among 90 persons vaccinated with Lot No. 319. Several lots among them, No. 350, 352 and 345 were used for one person only with no jaundice resulting. One lot, No. 367, was used for 5 persons none of whom became infected. Forty-eight persons surveyed had received no yellow fever vaccine and showed two clinical cases of jaundice although drawn from a population where the attack rate was 14%. (Table 13).

Distinct variation is to be seen in the frequency of jaundice resulting from administration of various lots of vaccines. In some instances, the proportion of those affected was as great as 56%, in others such as Number 362, it was decidedly minimal. It is further evident that a relatively small proportion of patients were severely enough affected to have been sent to hospitals. Among the 228, the proportion was 34 per cent. By far the greater number were ambulant, 66% and 135 others were only determined to have sub-clinical infections as the result of field investigation.

The attack rates of the three large groups who received vaccine of Lot Numbers 338, 351 and 368 were respectively 25%, 13% and 15%. This variation was conceivably either a function of the vaccine itself or that those groups were subjected to circumstances favorable to the spread of an epidemic hepatitis having an origin independent of the vaccine. If the latter were true, then a variable attack rate would be expected among different groups of men receiving

the same lot of yellow fever vaccine. The best proof that the attack rate was a function of certain lots of vaccine was in respect to Lot No. 368, which was administered to at least three groups of men represented in this study. Virtually similar attack rates for jaundice were observed in all three.

In summary, certain lots of vaccine were associated with a higher attack rate for jaundice than others. There was indication that for one lot, No. 368, the attack rate was the same when given to three different groups having little or no contact with each other. This was determined to be a regular observation.

Relationship of Date of Inoculation to Incidence of Jaundice.--

In an attempt to determine whether there was any relationship between the date of inoculation and incidence of jaundice, the two lot numbers associated with the largest numbers of cases, No. 338 and 368, were selected for study and the incidence of jaundice determined for each according to the time of administration, using half month periods. The results of this analysis in Table 14 show no apparent relationship between these two factors. The incidence of jaundice irrespective of the time of the year or the troops to which it was given, regularly led to about the same frequency of clinical disease.

Incubation Period According to Lot of Vaccine.--The field survey methods were not believed to have given sufficiently accurate dates of onset to warrant computation of incubation periods or more properly the elapsed time from the date of yellow fever inoculation to the onset of symptoms. Reports were available for 298 cases in which the onset of symptoms was determined by the medical officer caring for the patient with jaundice. Table 15. Only four lots of vaccine were concerned with sufficient numbers of cases to warrant analysis. The scatter of incubation periods by weeks for each gave no evidence of a characteristic incubation period for any given lot, except that Lot No. 338 generally gave evidence of greater delayed reaction. Figure 4 illustrates the time distribution for the 298 cases of jaundice.

Effect of Other Immunizing Agents on the Incubation Period.--

Most of the troops inoculated with yellow fever vaccine had also been immunized against typhoid, small pox and tetanus. The question arose as to whether inoculation with one or more of these immunizing agents at or near the time of yellow fever vaccination had any effect on the incidence of jaundice. Unfortunately, the immunization records in respect to the three other agents were not available except for reports submitted by Surgeons of various commands in the British Isles. Of 298 cases on which reports were received, 169 had been immunized with yellow fever vaccine Lot No. 368 and this group was therefore selected for further study. No incidence rates could be computed since all the individuals had developed jaundice, so incubation time was decided upon as the next best

criteria for determining the possible influence of other immunizations. The period at or near the date of yellow fever immunization was arbitrarily defined as comprising 20 days before or after that date.

The results of the analysis are given in the accompanying table. The cases were divided into those receiving no other immunization during the specified 40 day period and those receiving any one immunization, any combination of two, or all three, making in all eight categories. Each of these was further subdivided by length of incubation period (from yellow fever inoculation to onset of symptoms) in ten day groupings.

The incubation period for each classification would seem to be fairly symmetrically arranged about the 81 to 100 day period. Inoculation with other immunizing agents at or near the time of yellow fever vaccination would appear to have had little or no effect upon the incubation period, Table 16.

Interval Between Yellow Fever Inoculation and Jaundice.--

The interval in weeks that elapsed between the administration of yellow fever vaccine and the development of jaundice is illustrated in Figure 5 from survey reports. It is to be observed that the most common period was in the fourteenth week and that arrangement about that point was representative of a symmetrical distribution. The data include all patients developing jaundice within the year 1942-43 who had ever received yellow fever vaccine. The particular purpose in arranging this material was to determine the possible existence of secondary or tertiary waves of jaundice, this interest relating to communicability of the condition. If the usual incubation period is accepted as about 14 weeks, then a secondary rise should be evident about 28 to 30 weeks. There was a slight increase. A third wave would be apparent somewhere around the 40th week, and is again manifest. A fourth wave would appear about the 55th week, and again a slight indication of such a phenomenon appears in the diagram. This is the only evidence indicating a possible communicability of the condition.

Epidemic Jaundice Among Troops Not Immunized Against Yellow Fever.--The preliminary field investigation among recently arrived American troops in Northern Ireland gave information of 32 soldiers who had not received yellow fever vaccine. All others of the 1045 investigated at that time had been inoculated with the vaccine. The number of non-immunized persons was subsequently increased to 39. No jaundice occurred among these soldiers despite the fact that they belonged to various military units in which the attack rate for jaundice was about 14%. This circumstance was considered to bear importantly on the origin of the condition.

In consequence, more than usual attention was given to a report from the 10th Station Hospital, Londonderry, that 8 patients with jaundice of varying degrees of severity had been admitted and

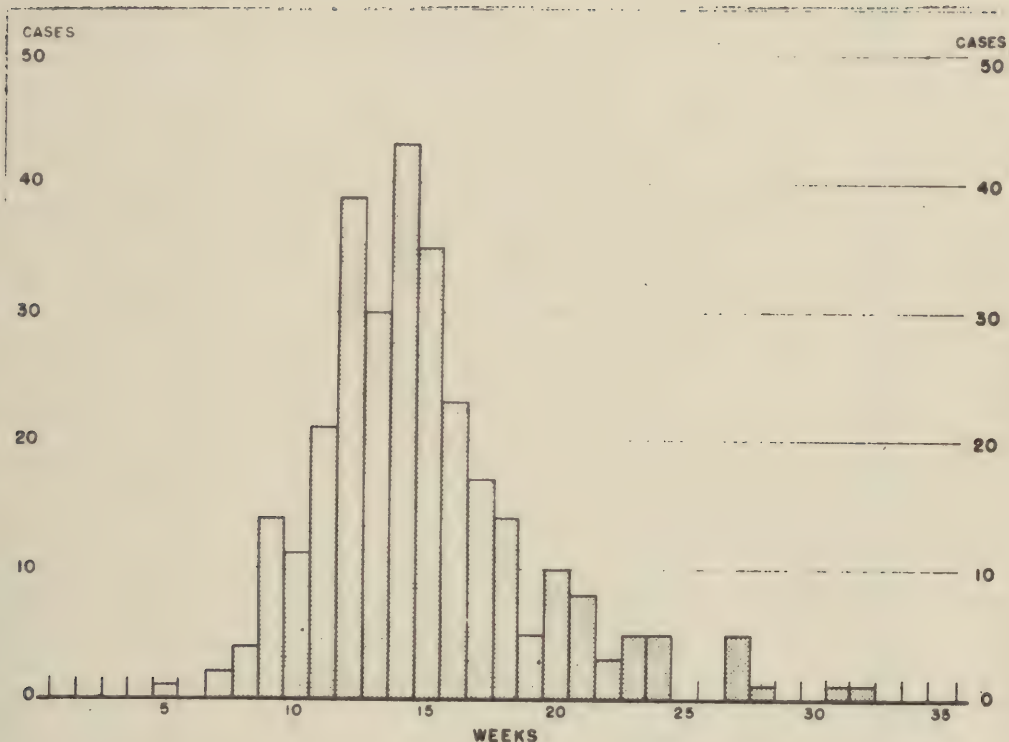


Figure 4.

Incubation periods of 298 cases of jaundice, North Ireland Force, European Theater of Operations, U.S. Army, Number of weeks between inoculation and onset of symptoms, February to May 1942.

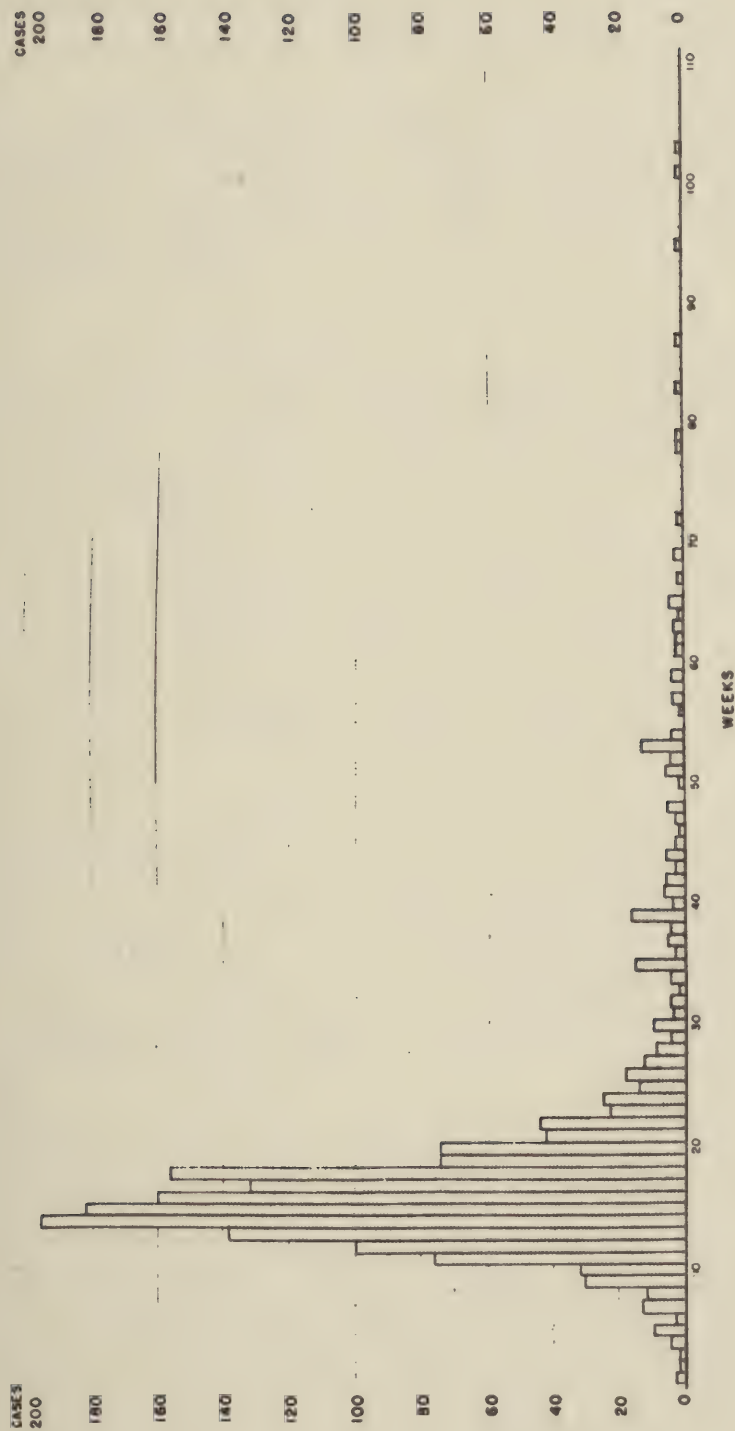


Figure 5.

Interval in weeks between yellow fever inoculation and onset of jaundice, European Theater of Operations, U.S. Army, February to May 1942, inclusive.

had received no previous yellow fever vaccine. The etiology of the condition was obscure. All presented the usual objective and subjective symptoms of epidemic hepatitis, none were seriously ill and none of the patients had died.

The eight patients belonged to the 151st Field Artillery; one to Battery A, four to Battery B and one to Battery C, one from the Service Battalion, and one from the Headquarters Battalion. The cases from Headquarters Battalion, Battery A and the Service Battalion were all officers who had been more or less in contact with each other.

The significant feature of this group of eight patients with jaundice was that none of the men had been vaccinated against yellow fever. While this information could not be substantiated by actual inspection of their immunization records, it seemed definite from medical histories obtained from the patients and from the word of one of their officers, himself a patient. In respect to the officer, his immunization record was produced and contained no mention of yellow fever inoculation. In general, the troops to which these patients belonged had not been immunized and there seemed no reason to doubt the history given. The medical officer of the unit confirmed the absence of administration of yellow fever vaccine. Furthermore, the period between any possible exposure to American troops arriving in May and the date of onset of these eight cases made contact through that channel impossible.

If an extraneous source of infection for this group could not be determined, doubt would necessarily exist about the relationship of the currently prevalent jaundice to inoculation with yellow fever vaccine. The best assumption seemed to be that these soldiers had been exposed to ordinary epidemic hepatitis in Ireland and that the disease from which they were suffering was of altogether different origin from that among the newly arrived American troops whose jaundice could be traced to America.

The camp of the 151st Field Artillery had been located for several months since January 1942 near the village of Ballyrena. From the local health officer it was learned that ordinary epidemic hepatitis had appeared in August 1941 in Ballyrena, with a considerable number of cases that frequently involved two or three children in the same family. Further cases had occurred during December 1941 and thereafter the outbreak spread up and down the coast, involving a number of villages including Port Rush, McGilligan Point and others. A goodly number of cases still existed in April and the disease was prevalent at McGilligan Point which was the area in which the camp of the 151st Field Artillery was located. The lady health officer recalled the existence of jaundice among 3 or 4 children during the week of April 8. She spoke particularly of an outbreak involving the Quigley family who lived directly opposite

the entrance of the army camp. Essentially one month later, the usual incubation period for this infection, on May 4, the first case of jaundice appeared in an American soldier. All subsequent cases developed within that month. The explanation of jaundice among non-inoculated members of United States forces in Northern Ireland seemed therefore to depend on contact infection from a thoroughly widespread outbreak of epidemic hepatitis in the region in which they were stationed. Local doctors volunteered that contact between soldiers and civilians was close, and that American soldiers were highly esteemed in the community.

Added evidence in respect to the prevalence of ordinary epidemic hepatitis in the region was furnished by the outbreak among British soldiers stationed at Coleraine, about 12 miles distant. This occurred in August and September 1941.

Comparative Attack Rates between Inoculated and Uninoculated Troops.--In further elaboration of the relationship between inoculation with yellow fever vaccine and the occurrence of jaundice among American troops, information was gathered from medical officers in charge of troops in Northern Ireland, concerning soldiers who had not received yellow fever vaccine.

The outbreak of jaundice had involved particularly the troops arriving about 12 May. Almost all had been inoculated with yellow fever vaccine and the attack rate was relatively great, 17%. Some 316 soldiers of this contingent for one reason or another had not received yellow fever vaccine. No jaundice occurred in the group. This was also true of a smaller group of 12 men whose time of arrival was irregular since they reported as casuals, but who arrived in the theater during the same general period. Table 17.

A division of United States soldiers had arrived in Northern Ireland on January 26, preceding the main contingent by about 3 1/2 months. Many had not been inoculated with yellow fever vaccine prior to their departure, in all 3379 individuals. Eight cases of jaundice had occurred in this group. The 8 cases constituted the outbreak just described. Aside from this localized outbreak related to Irish sources, the remaining 3371 men had been unaffected by jaundice.

The attack rate for jaundice among all yellow fever immunized troops of the May 12 group was about 17%. The attack rate for jaundice among the non-immunized troops of the January 26 group was 0.24%, about the usual attack rate for sporadic epidemic hepatitis.

Communicability of the Disease

A number of field observations contributed evidence bearing on the communicability of homologous serum jaundice. It is

well known that ordinary epidemic hepatitis is infectious and transmissible, and that the usual attack rate amongst attendants of such patients is relatively high. Consequently evidence on the communicability of the jaundice that followed immunization with yellow fever vaccine was sought from the study of the reactions of contacts to patients with the disease.

The Medical Detachment of the 5th General Hospital included some 260 persons, physicians, nurses and enlisted men. They were responsible for the care of most of the patients with jaundice during the epidemic. No case of jaundice with the possible exception of one subclinical infection was determined by survey of this group in May. A further examination by direct survey at the end of June and again in November 1942 showed a single case of jaundice to have occurred after the original examination. This was the case of accidental inoculation jaundice described separately below. No contact or other infections occurred.

Troops among whom jaundice was occurring were in some instances billeted in close contact with civilian populations known by inquiry to have been previously free from infectious jaundice. Inquiry made at the end of four months showed no transfer of the condition to civilians.

Opportunity was further presented to determine the possibility of transmission by contact between military organizations. Much jaundice had occurred among the troops of the 13th Armored Regiment. The 106th Coast Artillery was stationed in close contact with that organization. The Artillery unit had not been immunized against yellow fever, and subsequently over a period of four months showed no cases of jaundice.

Jaundice Following Accidental Inoculation

Evidence of another sort indicated that the disease could be transmitted by accidental inoculation of blood or serum from persons suffering from the condition.

In June 1942, in the course of caring for patients who developed hepatitis with jaundice after vaccination with yellow fever vaccine, a ward surgeon of the 5th General Hospital jammed a hypodermic needle into his finger after taking blood from a patient relatively early in the course of the disease. The needle was introduced far enough into the finger to hang suspended without support. It was promptly removed and the finger encouraged to bleed freely. Four months later, about 1 October, the surgeon developed symptoms characteristic of the hepatitis which followed administration of yellow fever vaccine. The onset was insidious, with vague gastrointestinal complaints over a period of two weeks. The urine was dark, gave a positive test for bile and had an increased concentration of urobilinogen. Jaundice of the sclerae soon became

apparent. There was no fever; the liver was enlarged and tender. The initial phase of the illness was accompanied by a skin eruption most marked over the buttocks.

The jaundice was moderate and the usual symptoms were present for three to four weeks. Improvement was extremely slow, the liver did not return to normal for eight weeks, and in December the patient had not recovered his full strength. While no specific test could determine the nature of the illness, the disease was indistinguishable from the hepatitis following yellow fever vaccine. There had been no epidemic hepatitis in the command, although patients had been admitted with this disease.

It was assumed that the ward surgeon inoculated himself with an infectious agent which had been the cause of the outbreak of jaundice following vaccinations with yellow fever vaccine. The incubation period was most suggestive. He had received yellow fever vaccine of Lot No. 327 or 342 in January 1942, neither of which were incriminated in the outbreak of jaundice, and the elapsed time also served to eliminate that source of infection.

Case 2. A woman technician who had never been vaccinated against yellow fever developed jaundice. From June until November 1942 she determined over a thousand icteric indices in cases of acute hepatitis of yellow fever vaccine origin. She remembers sucking serum into her mouth on two occasions, in August or September 1942. On 17 October she had loss of appetite and mild pain in the upper right quadrant of the abdomen; on 20 October nausea and vomiting. The following day the white cell count of the blood was 5,000. On 27 October the urine became dark red, followed two days later by icterus of the sclerae.

Recommended Preventive Measures

Unit commanders were instructed to examine immunization registers in order to determine those officers and men who had been inoculated with lots of yellow fever vaccine brought under suspicion by the survey findings. These lots were Nos. 317, 319, 320, 333, 335, 338, 351, 360, 367, 368.

For such individuals a high carbohydrate diet was advised for six months after inoculation, avoiding or at least greatly decreasing fried foods and particularly greasy foods. Arrangements were made to provide wherever practical an increased candy ration for this group and also increased amounts of other carbohydrate foods such as molasses, honey, syrup, preserves and jam.

It was further advised insofar as compatible with military requirements that these individuals avoid severe or long continued mental or physical exertion, and exposure to unfavorable environmental conditions.

Unit surgeons were instructed to be on the lookout for change of bowel habits, undue fatigue, biliousness and dark urine, and to encourage troops to report promptly the occurrence of any of these symptoms.

HOMOLOGOUS SERUM JAUNDICE AFTER TRANSFUSION

The outbreak of jaundice following yellow fever vaccination and that associated with passive protection against mumps by convalescent serum naturally directed attention in 1942 to the pertinent possibility that similar events were occurring as a result of transfusion of blood, and the intravenous use of such blood fractions as plasma and serum for the treatment of shock after wounds.

Early studies by the British Ministry of Health and by the Jaundice Committee of the Medical Research Council readily established that this was so. The Ministry of Health collected records of 456 British soldiers convalescent from wounds in Emergency Medical Service hospitals in Great Britain. All had received plasma or blood and had been in hospital 100 days or more. Thirty six developed jaundice, in the proportion of 79 per thousand transfused men, and the mortality rate was 20 per thousand. Only 3 cases of jaundice occurred among 1741 wounded men who had not been transfused, but were in hospital at the same time and under the same conditions.

Similar suggestive instances were noted in American practice but the number was small, the cases were isolated and there was always the question of the infection being related to naturally acquired epidemic hepatitis. Not until the number of casualties increased with the opening of the continental campaign, and transfusion of blood or blood products became more common, was it evident that jaundice due to an icterogenic agent in blood plasma or serum was a matter of equal concern to the U. S. Army.

The incubation period of this condition, which is another form of homologous serum jaundice, is about three months. Consequently reports of American experience first became available in any considerable numbers in the autumn of 1944, the first coming from the 7th General Hospital.

A series of 14 cases of jaundice was observed among surgical patients convalescent from wounds, who had received plasma some months previous to the development of jaundice. Several had received blood as well. The infections were relatively severe and several had ended fatally. Epidemic hepatitis was an uncommon disease in Great Britain at that time. That and the localization of cases among surgical patients made it probable that the condition was homologous serum jaundice.

Corroborative evidence soon came from the 297th General Hospital where 30 patients with jaundice had been observed among 6,000 admissions, about evenly distributed between the medical and surgical services. Fifteen cases were considered in all probability to have been homologous serum jaundice. The disease was of a fulminating variety and three patients had died.

Inquiries were instituted among general and station hospitals in Britain where the majority of wounded retained in the theater were in hospital. From reports received in the course of the next several months, up to 1 March 1945, from 49 hospitals in the United Kingdom, only nine hospitals gave a negative report. The remaining 40 reported 281 cases of jaundice among surgical patients occurring 45 to 100 days after transfusion of plasma or blood. Twenty one of the patients had died.

Information on 143 patients of the series was sufficiently detailed to permit further analysis. Patients who received plasma alone numbered 47, an additional 11 had been transfused with blood and the remainder had received both. Deaths among the 143 cases numbered 14, of which 5 had been treated with plasma alone and 2 with blood only. The illnesses were described by attending physicians as generally mild or moderate. When death took place it was almost invariably before the tenth day. Some patients died within four or five days of the onset of jaundice, the disease taking a violently unfavorable turn with disorientation rapidly followed by coma. The conspicuous feature of post mortem examinations was an almost total disappearance of liver cells.

During the period covered by this study, from late summer of 1944 to 1 March 1945, admissions to hospital in the United Kingdom for epidemic hepatitis were consistently low and deaths from this cause were decidedly few. The incidence of jaundice among patients who had been transfused was notably greater than that for persons who had not received blood fractions.

These data were collected from a variety of hospitals and in general depended upon the memory of physicians who treated the patients. Some few cases of epidemic hepatitis may well have been included but would appear to be more than balanced by unrecognized cases of homologous serum jaundice.

Patients recovered from wounds were ordinarily returned to one of the large reinforcement centers for convalescence. A survey of the 10th Reinforcement Depot revealed that during the months of August to November 1944 only 20 cases of jaundice had been noted among 34,478 battle casualties processed at the depot. In general these men represented the more mildly wounded who had not so commonly received blood transfusion.

Plasma would appear to be a more common source of homologous serum jaundice after transfusion than blood. The pools were larger. The ordinary unit of plasma represented contributions from at least eight donors and the number was sometimes as great as 25. The chances of an icterogenic agent being admitted would be in about that order for the two products.

SUMMARY OF ACUTE INFECTIOUS JAUNDICE

The preceding discussion has demonstrated that the problems of acute infectious jaundice in the European Theater were continuous, diverse and often confusing in nature.

Epidemiologically two separate kinds of jaundice could be distinguished. The first was a specific disease entity as separate and individual as measles or mumps. This was epidemic hepatitis. It was present among troops of the United States Army from the early days of the theater until the close of operations. Truly epidemic proportions were reached in the spring of 1945, particularly among Ground Force units of the 7th Army which brought the infection with them from Italy where epidemic hepatitis had been consistently at a high epidemic potential. The mode of transmission remained unsettled, except that the experience in the European Theater served rather definitely to eliminate insects as a consideration. The weight of evidence suggests that spread of the infection was chiefly by secretions from the upper respiratory tract, which was the common opinion among surgeons of units where the disease was prevalent. Certain outbreaks were suggestive of an origin from water, or from food, or otherwise by way of the intestinal tract. That such means constituted the ordinary and usual route would not appear likely in view of the broad epidemiologic behavior of the disease, which is much more like that of an infection transmitted by secretions of the respiratory tract than by the intestinal route. The causative agent remains undemonstrated, although the accumulated evidence continued to support a probable filtrable virus.

Homologous serum jaundice appeared to be a separate condition, the chief evidence in support being the outstandingly different incubation period and the lack of communicability. The icterogenic agent was rather commonly present in the blood serum of apparently normal human beings. The two epidemiologic manifestations of the condition, the outbreak of jaundice after yellow fever vaccine and that which followed transfusion, appeared to be representative of the same phenomenon.

Jaundice after treatment for syphilis by arsphenamines was a minor consideration. The origin was mixed, in some instances arising by the same mechanism responsible for homologous serum jaundice and in others corresponding to a normal infection of the

nature of epidemic hepatitis. It is not to be considered an individual problem, but related to one or other of the two principal forms of jaundice.

Leptospirosis or Weil's disease was the most unimportant among problems of acutely developing jaundice. The disease was rarely observed.

NEUROTROPIC VIRUS DISEASES

The neurotropic virus diseases were never of great concern in the European Theater. Lymphocytic choriomeningitis was not a reportable condition and its frequency among disease conditions is not known. Discussion will be limited to poliomyelitis and encephalitis of the group transmitted by secretions of the upper respiratory tract with brief consideration of the preventive measures employed against rabies, of which no case occurred.

Poliomyelitis

Poliomyelitis was a most uncommon disease in the European Theater. Four cases occurred in 1942 and the same number in 1943. The year of greatest prevalence was 1944 with 36 patients among the theater population. The data for 1945 are for the first six months of the year and the 24 cases therefore represent a rather decided excess prevalence, in that all occurred before the time of usual seasonal prevalence. The average annual rate of incidence during the period of operations was 0.02 per thousand strength per annum, which compares very favorably with the rate among soldiers stationed in continental United States which was 0.03; and for total troops in overseas areas where the rate was 0.07. (Table 18)

The China-Burma-India Theater had the greatest frequency of poliomyelitis with a rate of 0.23 and the Southwest Pacific was next. No cases were reported in the Alaskan Theater. The data include poliomyelitis as well as poliomyelitis.

Encephalitis

Encephalitis in the European Theater was a rarely recognized condition. One case is included in the medical records of 1944 and two came to report in 1945.

Most cases of encephalitis came from the theaters in the far eastern area. The China-Burma-India Theater had the greatest number with 18, followed closely by the Pacific Ocean Area and the Southwest Pacific. The incidence in these areas was largely related to the outbreak of Japanese B encephalitis on the island of Okinawa. The records for the other theaters of operation were much the same as those in the European Theater.

The greatest number of cases by far, 320, came from troops stationed in continental United States. (Table 19)

Rabies

Despite the far flung activities of the United States Army during the course of the war just passed, not a single case of rabies occurred among troops serving in any of the theaters of operation. Two cases were reported from continental United States.

It was a novel sensation in the experience of most American physicians to be able to look with complete equanimity on the occurrence of a dog bite among patients of their practice. Rabies had been so long absent from Great Britain by reason of the stringent quarantine practiced in that country that no need existed for administration of anti-rabic vaccine after bites by dogs or other animals. The last rabies in Great Britain occurred at the time of World War I.

A small stock of anti-rabic vaccine was maintained at theater headquarters in Great Britain to care for unusual situations but was rarely drawn upon. In only one instance did the need exist. An officer of the Air Corps freshly arrived from the Zone of the Interior had been bitten by a dog previous to his departure. On arrival in the United Kingdom, word awaited him that the dog had died. Anti-rabic vaccine was not immediately available at the port of debarkation, and a civilian source of supply could not be located. Without more ado the officer took the next plane back to America for preventive treatment.

The rabies situation in France was almost as favorable. The records of the Institut Pasteur contained no definite case of rabies in animals for some years, and no human had died from rabies in France for 16 years.

Rabies was reported in Berlin in 1945 and occasional infections among animals were recognized in northwest European countries. Most American medical officers consequently returned to traditional practice in the management of dog bites. Such instances were not frequent and stocks of anti-rabic vaccine were not maintained in theater depots generally.

Vaccine was obtained promptly by requisition on the Supply Division of the Medical Department at theater headquarters through arrangements made with the Institut Pasteur by which that organization furnished all anti-rabic vaccine required by American troops.

No serious program of prevention was undertaken. The principal effort was directed toward inclusion with the provisions

relating to sanitary control of air traffic, of prohibition on importing dogs and other pets into the theater area. The enforcement of this regulation brought a number of troublesome situations, but the American forces had a distinct obligation to prevent introduction of this transmissible disease. Previous to shipping military guard dogs to operational areas in France, they were immunized against rabies.

TETANUS

No more astounding example can be cited in support of the progress made by preventive medicine in recent years than the circumstance that in a war of three and a half years duration, with battle casualties that numbered 395,488, a single case report constitutes the record for tetanus. The measures employed for the prevention of the disease have been set forth in the section on specific immunization. The single case that occurred in the European Theater of Operations terminated fatally.

EPIDEMIOLOGIC CASE REPORT NO. 3 - A private first class of Company B, 30th Infantry Division, 119th Infantry, received a perforating gun shot wound of the right foot as the result of enemy action in an unknown locality in France, 1700 hours, 27 August 1944. Emergency treatment including 1 cc. of tetanus toxoid was administered at the battalion aid station four hours after the injury.

The wound was debrided and a boot cast applied at 0310 hours, 29 August at the 77th Evacuation Hospital. The patient was evacuated to the 128th General Hospital in Great Britain on 31 August and his condition was good when he arrived. At 1800 hours the next day he noted a stiffening of the jaw while eating his evening meal, and at 2100 hours he experienced a definite spasm of the masseter muscles. During the next four days he received 380,000 units of tetanus antitoxin, liberal doses of penicillin, blood plasma, sulfadiazine and a minimum of 2,000 cc of five percent dextrose saline solution. The patient died of strangulation at 1400 hours on 5 September 1944 in spite of an emergency tracheotomy and after previous apparent improvement.

Tetanus toxoid had been administered in January 1944 as an original series and a stimulating dose was given on 28 August 1944, approximately four hours after injury.

The situation was not so satisfactory in regard to German prisoners of war, but does give excellent indication of the number and kinds of casualties which would have been experienced by the United States Army in the absence of the methods of prevention that were employed. The German Army did not use tetanus toxoid.

Only incomplete information is available but it is known, for example, that during the period 17 September to 2 October 1944, no less than 53 German prisoners of war were received in hospitals in the United Kingdom with tetanus, of whom 16 died. A further record of tetanus among German prisoners of war is obtained from the records of the Advance Section of the Communications Zone, where from September 1944 to June 1945, 70 cases of tetanus were observed among German prisoners. The number of deaths that occurred in this group is not known, but for the period 1 May to 15 June 1944 there were 13 deaths from tetanus among prisoners of war.

Other Theaters of Operation.---The experience of the European Theater was by no means unique. For all theaters of war there were only 3 cases of tetanus; 1 in the China-Burma-India Theater and one in the Mediterranean Theater in addition to that just described for the European area.

It is a most peculiar circumstance that in those areas where the war was fought there were 3 cases of tetanus; while in continental United States among troops in training the number was 10. (Table 20)

SCABIES

Both on the Continent and in the United Kingdom, the troops of the European Theater were situated among a civilian population where scabies was prevalent. The frequency of the disease was measurably enhanced in all countries of the war zone and continued so throughout the duration of hostilities. Conditions on the Continent were worse than in the United Kingdom. The rates that prevailed in the American Army are judged satisfactory compared with those experienced by British troops. Figure 6

The disease was most common in 1943 with an average annual rate of 9.02 (Table 21). That most of the cases were contracted in Europe was demonstrated by repeated surveys of recently arrived troops which showed almost universal freedom from this skin disease. This was in agreement with usual American experience, in that scabies was no problem in camps of continental America. Judged by the single year of operations on both the Continent and the United Kingdom, no great difference existed between the frequency of scabies in the two areas. The rates were almost identical. (Table 22)

Among Theaters of Operation of the United States Army, the rates for scabies in the European Theater were relatively great, since the theater occupied second place, being exceeded in the frequency of this condition only by the Mediterranean Theater. The rates for the theater were essentially twice those of Continental United States. (Table 23)

ANTHRAX

In Great Britain no question ever arose of anthrax infection among civilians associated with American troops, nor among troops themselves. France by contrast is traditionally the seat of small localized endemic foci, principally on the Brittany peninsula.

The first report of this disease from American occupied regions on the continent came on 8 August 1944. Two butchers and a farmer at Briec near Quimper in Brittany had slaughtered a cow and developed cutaneous anthrax. The bizarre nature of the disease and the lack of familiarity on the part of American physicians led to more than usual activity when the report of the outbreak was received. Investigation showed that in addition to the three human cases, some 30 instances of anthrax infection among animals had occurred within recent weeks on seven farms. Veterinary officers of the Civil Affairs Division aided local authorities in instituting control measures and in obtaining supplies of anti-anthrax serum. A special investigation by the Preventive Medicine authorities led to certain assurance that no significant health problems in relation to American soldiers was likely to arise from the circumstance.

A number of suspected cases of anthrax continued to be reported in the succeeding autumn months but the next confirmed case of the disease of which record exists was on 2 June 1945. This was a single infection in man. No instance of anthrax infection was ever suggested in an American soldier. The numbers stationed in endemic regions were always small.

LEPROSY

Two cases of leprosy were reported in the theater during the course of operations in France. The onset of both antedated military service.

The first case was recognized during the week ending 22 December 1944. The patient, a soldier aged 39 years, white, and a native to Texas, had had a tour of duty in the Philippines and China from 1933 to 1937. Later he spent a year in Panama, in 1939. The first cutaneous manifestation of leprosy apparently developed there, for a diagnosis of erythema multiforme was made. When first seen in France he had deeply pigmented anesthetic areas generally distributed over the body. There were nodular lesions on the face. *Mycobacterium leprae* was recovered from smears from the nose and the organism was particularly numerous in biopsy tissue. In view of the recovery of the bacterium from the nose, the infection was considered an open case of the maculo-anesthetic type.



Figure 6.

Scabies, American and British Armies in the United Kingdom, rates per 1000 strength per annum, February 1942 to January 1944, inclusive.



The patient had had the characteristic leonine expression for approximately a year. After service in the United States Army until 1933, he returned to his home in San Antonio, Texas where he remained until he re-enlisted in 1937. He served tours of duty at posts in Louisiana, Southern Texas and in the Canal Zone, all endemic areas of leprosy. The first manifestation of the disease was the appearance of annular lesions on the chest and abdomen in 1943 while in the Canal Zone. Although some of the lesions were known to be anesthetic, the diagnosis of erythema multiforme was maintained until admission to hospital in 1944.

The second patient was a Puerto Rican born in San Turce, Puerto Rico where he had lived until he was inducted into the Army. He reported to Fort Dix in 1943 where he spent five months. He was transferred to England and subsequently to France and Belgium. While in England in October 1944 he reported a lesion on his face, was told it was merely an eruption and to go back to duty. On 8 February 1945 he again reported to the dispensary and was admitted to a General Hospital. Examination of a nodule of the forehead demonstrated the leprosy bacillus. There was no family history of leprosy or of exposure to patients with leprosy. It is not believed that he had been exposed while in the military service. The disease was manifested by nodules on the face with some deformities, some crusting of the lesions and anesthesia of the little fingers of both hands. Smears from the nose were positive.

Of the 20 cases of leprosy originating among troops of the entire Army during the period of the war, January 1942 to June 1945, twelve were recognized in Continental United States and eight in overseas Theaters of Operation. It is to be noted that the official records of the Medical Statistics Division credit the European Theater with one case, but actually there were two. The most common source of leprosy outside of the United States was the Pacific Ocean Area with six cases, and one each came from the Mediterranean Area and the Africa-Middle East Theater. (Table 24)

UNDULANT FEVER

Undulant fever, including cases reported as Malta fever, occurred among troops of the United States Army to the extent of 485 cases. The troops of continental United States showed by far the greatest frequency with 358 and only about one-third that number were recognized in theaters of operation. The Mediterranean had the greatest number, 70 cases, and the Pacific Ocean Area was next with 20. All theaters of operation were represented, but the Alaska Theater had only a single case.

Of the 12 cases reported in the European Theater, six occurred in 1944 and all were from Great Britain. Three of the six cases in 1945 were from that area and three originated on the Continent of Europe. (Table 25)

Table 1

Infectious Hepatitis

European Theater of Operations, U. S. Army

Cases and Rates per 1000 strength per annum, by months

February 1942 to June 1945, Inclusive

Month	Total		1942		1943		1944		1945	
	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate
January	1726	6.4			59	5.4	414	6.7	1253	6.4
February	1990	7.0	0	0	35	4.1	198	2.8	1757	8.5
March	4573	12.1	0	0	38	4.6	225	2.2	4310	16.3
April	3974	12.3	0	0	37	3.5	236	2.5	3701	16.9
May	2998	9.0	396	186.0	21	2.2	317	3.2	2264	10.2
June	2453	6.0	499	140.5	26	2.1	219	1.7	1709	6.5
July	648	4.8	380	59.4	70	3.7	198	1.8		
August	365	2.4	120	13.7	46	2.4	199	1.6		
September	368	1.8	67	5.3	54	2.3	247	1.5		
October	419	2.2	28	1.7	105	2.9	286	2.1		
November	958	4.7	36	3.2	527	12.9	395	2.6		
December	1751	5.8	37	4.0	771	11.9	943	4.2		
Total	22223	7.0	1563	21.5	1789	6.8	3877	2.6	14994	10.9

Source: Division of Medical Statistics, Office of The Surgeon General,
War Department, Washington, D.C.

Table 2

Infectious Hepatitis

United Kingdom and Continent

European Theater of Operations, U. S. Army

Cases and Rates per 1000 strength per annum by months

September 1944 to June 1945, Inclusive

Month	Total		United Kingdom		Continent	
	Cases	Rate	Cases	Rate	Cases	Rate
1944						
September	247	1.5	178	2.7	69	.7
October	286	2.1	187	4.5	99	1.0
November	395	2.6	243	5.9	152	1.4
December	943	4.2	334	5.6	609	3.7
1945						
January	1253	6.4	286	5.8	967	6.6
February	1757	8.5	322	6.8	1435	9.0
March	4310	16.3	377	7.5	3933	18.4
April	3701	16.9	312	8.1	3389	18.7
May	2264	10.2	247	8.3	2017	10.5
June	1709	6.5	172	3.7	1537	7.1
Total	16865	8.2	2658	5.6	14207	9.0

Source: Division of Medical Statistics, Office of
The Surgeon General, War Department,
Washington, D.C.

Table 3

Infectious Hepatitis

Total Army, Continental United States and
Theaters of Operations, U. S. Army

Cases and Rates per 1000 strength per annum
January 1942 to June 1945, Inclusive

Theater	Total		1942		1943		1944		1945	
	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate
Total Army	142678	6.7	38588	12.65	24284	3.60	30010	4.00	49796	12.8
Continental U. S.	34557	2.61	26029	10.26	3005	.59	2881	.72	2642	1.8
Total Overseas	108121	13.5	12559	24.5	21279	13.4	27129	7.8	47154	19.4
Mediterranean	37077	27.4	33	1.5	15865	36.8	14980	22.7	6199	25.8
South West Pacific	31202	25.9	1514	23.0	550	2.8	5025	9.1	24113	61.9
Alaska	3119	11.5	2959	58.91	50	.44	25	.30	85	3.6
China-Burma-India	3102	9.3	108	19.0	443	9.6	1928	12.1	623	5.1
Pacific Ocean Area	9049	8.7	5056	34.3	2248	7.6	812	2.1	933	4.5
European	22223	7.0	1563	21.5	1789	6.8	3877	2.6	14994	10.9
Africa-Middle East	762	5.8	81	14.1	257	4.8	294	6.2	130	5.4
North America	573	3.4	553	13.65	4	.06	7	.17	9	.6
Latin America	1014	2.9	692	6.73	73	.60	181	2.1	68	1.7

Source: Division of Medical Statistics, Office of The Surgeon General,
War Department, Washington, D.C.

Table 4

Weil's Disease

Total Army, Continental United States and

Theaters of Operations, U. S. Army

Number of Cases, January 1942 to June 1945, Inclusive

Theater	Cases
Total Army	18
Continental U.S.	1
Overseas	17
European	10
South West Pacific Area	6
Africa-Middle East	1
Alaska	0
China-Burma-India	0
Latin America	0
Mediterranean	0
North America	0
Pacific Ocean Area	0

Source: Division of Medical Statistics,
Office of The Surgeon General,
War Department, Washington, D.C.

Table 5

Infectious Hepatitis

AAF Station 113, 8th Air Force

European Theater of Operations, U.S. Army

Distribution of Cases by Date of Onset

25 March to 26 April 1944

Date	Total	Cases at AAF Station 113	Cases at other AAF Stations
March 25	1	1	0
April 10	1	1	0
13	1	1	0
14	2	2	0
15	6	1	5
16	3	2	1
17	11	2	9
18	9	6	3
19	6	3	3
20	6	1	5
21	6	2	4
22	7	4	3
23	8	5	3
24	1	0	1
26	1	0	1
Total	69	31	38

Source: Subject letter, Investigation of Epidemic Hepatitis, 8th AAF, to: Chief Surgeon, Hq ETOUSA, from Division, Preventive Medicine, Office of the Chief Surgeon, ETOUSA, dated 13 May 1944.

Table 6

Epidemic Hepatitis by Armies

European Theater of Operations, U.S. Army

Cases and Rates per 1000 strength per annum, by weeks

1 September 1944 to 29 June 1945, Inclusive

Week ending--	First		Third		Seventh		Ninth	
	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate
1944								
September 1	3	.6	1	.2	27	10.9	0	0
8	-	-	1	.2	23	9.2	0	0
15	4	.8	2	.5	20	8.5	0	0
22	2	.4	1	.2	33	14.5	0	0
29	-	-	3	.6	36	13.9	1	.3
October 6	4	.7	2	.5	51	21.8	2	.6
13	2	.4	1	.2	40	17.2	0	0
20	6	1.1	0	0	53	22.3	0	0
27	4	.7	2	.4	82	36.3	0	0
November 3	8	1.4	2	.4	82	37.0	5	1.5
10	4	.7	2	.4	73	29.0	1	.3
17	4	.6	4	.9	48	17.0	3	.9
24	7	1.1	2	.4	22	6.4	2	.5
December 1	7	1.1	2	.4	26	6.7	1	.3
8	6	1.0	3	.6	23	5.9	4	1.1
15	8	1.2	3	.6	29	7.3	7	2.0
22	9	1.3	5	1.0	32	7.7	3	.8
29	6	1.0	3	.5	39	9.3	2	.6
1945								
January 5	11	1.8	11	1.7	44	10.0	7	2.1
12	15	2.4	18	2.8	62	13.6	3	.9
19	13	2.1	11	1.6	73	15.5	11	3.1
26	14	2.2	22	3.2	96	18.5	20	5.8
February 2	9	1.6	19	3.0	111	19.4	32	5.7
9	12	2.5	21	3.6	130	21.6	19	3.8
16	39	6.9	19	3.3	99	18.7	21	3.6
23	17	2.8	40	7.0	124	23.9	26	4.5
March 2	10	1.6	57	10.3	206	38.5	18	3.0
9	37	6.1	78	13.3	203	39.2	18	3.0
16	25	4.1	67	11.3	234	39.1	40	6.5
23	30	4.9	97	15.6	319	53.1	55	8.9
30	37	6.0	100	17.2	307	51.2	56	8.6
April 6	49	7.5	86	14.4	170	30.2	31	4.8
13	42	5.9	92	15.1	181	32.7	32	5.1
20	43	6.0	123	21.7	139	25.1	32	5.1
27	81	12.4	138	19.0	132	22.9	31	5.1

Table 6 (cont'd)

Week ending-		First		Third		Seventh		Ninth	
		Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate
May	4	60	9.3	102	15.7	203	35.7	18	2.6
	11	35	6.5	32	4.2	112	17.5	19	2.8
	18			29	3.5	106	17.5	71	6.0
	25			61	7.3	126	20.5	101	9.0
June	1			53	6.3	93	15.5	55	4.8
	8			41	4.8	40	5.2	28	3.5
	15			55	5.0	42	3.7	0	0
	22			47	4.0	9	.9	0	0
	29			59	5.5	16	1.8	0	0
Total		663	3.0	1517	5.5	4116	19.3	775	3.8

Source: Division of Medical Statistics, Office of The Surgeon General, War Department, Washington, D.C.

Table 7

Epidemic Hepatitis in the Seventh Army by Divisions,
European Theater of Operations, U. S. Army,

Rates per 1000 Strength per Annum, by Weeks

September 1943 to April 1945

		3rd Infantry*	36th Infantry*	45th Infantry*	100th Infantry	103rd Infantry	44th Infan- try	14th Arm- ored	70th Infan- try	63rd Infan- try	42nd Infan- try
1943											
September	24	72		18							
October	1	138	3	75							
	8	260	3	46							
	15	291	6	57							
	22	377	10	67							
	29	315	0	93							
November	5	201	20	83							
	12	246	76	132							
	19	149	55	210							
	26	138	86	171							
December	3	183	80	153							
	10	128	69	86							
	17	142	74	67							
	24	127	130	59							
	31	113	127	65							
1944											
January	7	212	70	71							
	14	126	159	48							
	21	52	141	70							
	28	109	123	14							
February	4	93	95	54							
	11	74	98	31							
	18	48	59	43							
	25	37	53	23							

Not in Theater

Table 7 (Continued)

Epidemic Hepatitis in the Seventh Army by Divisions

	3rd Infantry*	36th Infantry*	45th Infantry*	100th Infantry	103rd Infantry	44th Infan- try	14th Arm- ored	70th Infan- try	63rd Infan- try	42nd Infan- try
1944										
March	3	49	60	18						
	10	44	35	9						
	17	54	46	9						
	24	39	44	15						
	31	49	28	27						
April	7	9	10	26						
	14	21	23	5						
	21	42	6	7						
	28	38	12	5						
May	5	8	12	7						
	12	8	6	7						
	19	13	0	0						
	26	8	6	9						
June	2	17	12	12						
	9	10	5	6						
	16	15	2	0						
	23	11	9	0						
	30	0	3	14						
July	7	8	0	0						
	14	0	19	14						
	21	14	3	9						
	28	10	0	12						
August	4	3	16	3						
	11	6	0	0						
	18	3	0	3						
	25	18	14	3						
September	1	22	11	3						
	8	16	4	12						
	15	6	4	0						
	22	16	7	6						
	29	28	14	3						
October	6	10	10	9						
	13	10	11	24						
	20	29	29	18						
	27	30	30	33						

Not in Theater

Table 7 (Continued)
Epidemic Hepatitis in the Seventh Army by Divisions

	3rd Infantry	36th Infantry	45th Infantry	100th Infantry	103rd Infantry	44th Infantry	14th Arm- ored	70th Infan- try	63rd Infan- try	42nd Infan- try
November	3	40	9	**	**					
	10	22	9	20	11	**				
	17	14	15	21	11					
	24	14	14	14	4					
December	1	25	16	8	4					
	8	22	31	8	8					
	15	36	15	4	15		**			
	22	36	21	21	11	3				
	29	37	31	4	15					
1945										
January	5	41	9	34	34					
	12	60	18	3	44					
	19	30	37	84	84	6		**		
	26	28	75	53	94					
February	2	56	69	106	58		20		**	
	9	83	52	110	97	18				
	16	48	31	90	77	28		4		
	23	44	34	85	123	27				
March	2	59	33	311	83	26	14			
	9	25	65	259	132	62	23	3	51	
	16	64	30	295	146	63	23	30	48	
	23	86	61	437	149	119	23	40	48	
	30	42	63	404	223	88	14	67	62	
April	6	45	49	164	131	49	35	67	75	23
	13	34	21	235	92	35	9	21	49	4
	20	15	21	186	69	20	45	50	104	15
	27	37	31	146	53	33	73	97	59	17
							44	110	62	3

* With Fifth Army, Mediterranean Theater until 9 June 1944.
Landed Southern France -- 15 August 1944.

** Date committed to combat.

Source: Division of Preventive Medicine, Office of the Chief Surgeon, European Theater of Operations, U. S. Army

Epidemic Hepatitis in 104th Infantry Division
European Theater of Operations, U.S. Army
Distribution of Cases by Companies and Date of Onset
5 January to 16 February 1945

Date	413th Infantry Companies:										414th Infantry Companies:										415th Infantry Companies:										692 T.D. Hq	329 Med Bn CoC	Div. Total		
	Hq	C	E	G	L	AT	2Bn	Total	Hq	A	C	D	H	I	M	AT	SV	1Bn	3Bn	Med	Total	Hq	B	D	F	K	Med	Total							
Jan 5								1																									1		
9							1																										1		
10	1																																		1
13																																			1
15																																			1
16																																			1
18																																			1
19																																			1
20																																			1
21																																			1
22																																			1
23																																			1
24																																			1
25																																			1
27																																			1
28																																			1
29																																			1
30																																			1
31																																			1
Feb 1																																			1
3																																			1
5																																			1
6																																			1
7																																			1
9																																			1
10																																			1
13																																			1
14																																			1
15																																			1
16																																			1
Total	1	1	1	2	1	2	2	10		6	7	1	4	4	2	2	1	1	1	1	32		1	3	2	1	1	3	11	2	1		56		

Source: Subject, Jaundice 104th Division, to Surgeon, First U.S. Army, from 10th Medical Laboratory, 19 February 1945.

Table 9

Homologous Serum Jaundice of Origin from Yellow Fever Vaccine
Cases by Week of Onset, Special Study Survey,
North Ireland and England, European Theater of Operations, U.S. Army
January to September, 1942

Week Ending		Total	North Ireland	England
1942 January	6-21	4	4	
February	7	2	2	
	14	-	-	
	21	2	2	
	28	3	3	
March	7	5	5	
	14	5	4	1
	21	12	10	2
	28	17	16	1
April	3	36	35	1
	10	75	75	-
	17	89	89	-
	24	101	100	1
May	1	109	104	5
	8	85	85	0
	15	116	112	4
	22	127	125	2
	29	92	89	3
June	5	127	112	15
	12	113	95	18
	19	126	103	23
	26	69	55	14
July	3	110	89	21
	10	110	61	49
	17	77	56	21
	24	59	35	24
	31	48	32	16
August	7	50	26	24
	14	32	17	15
	21	31	18	13
	28	27	9	18
September	4	14	4	10
	11	18	10	8
	18	16	6	10
	25	8	3	5
Total		1915	1591	324

Source: Final report, Homologous Serum Jaundice arising from use of Yellow Fever Vaccine, Office of the Chief Surgeon, European Theater of Operations, U.S. Army, 1942.

Table 10

Incidence of Jaundice, North Ireland Forces

European Theater of Operations, U.S. Army

Cases and Attack Rates by Lot Numbers of Yellow Fever Vaccine

January to May 1942

Lot No.	No. Persons Vaccinated	No. Cases Jaundice	Attack Rate (per 100)
Unknown	3018	1	0.03
Special Issue	36		
33	1		
42	3		
74	50		
140	1		
142	79		
217	3		
233	1		
242	7		
249	1		
253	26		
300	1		
301	1		
308	1	1	-
309	3		
310	5		
317	94	1	1.1
318	6		
319	508	24	4.7
320	18	1	5.6
324	4		
325	1		
327	91		
329	1		
330	194		
332	101		
333	91	8	8.8
334	2	1	-
335	206	23	11.2
337	2		
338	3038	287	9.4
340	1873		
340.1/2			
341	991		
342	2733		
343	178		
344	10		
345	70		
346	1625	1	0.06
347	45		
348	159		

Table 10 (cont'd)

Lot No.	No. Persons Vaccinated	No. Cases Jaundice	Attack Rate (per 100)
350	102		
351	1093	33	3.0
352	37		
353	3119	1	0.03
355	2		
357	2		
358	627		
359	133		
360	919	3	0.3
361	20		
362	46		
363	2		
364	29		
365	31		
366	1		
367	153	14	9.2
368	1752	186	10.6
369	13		
370	8		
371	19		
372	49		
373	303		
375	4		
379	2		
380	70		
381	5		
382	20		
383	2		
384	1		
386	99		
387	74		
388	18		
391	3		
392	22		
396	3		
397	2		
409	20		
423	29		
460	1		
551	112		
888	1		
Total	24,249	585	2.4

Source: Interim report number 9, Homologous Serum Jaundice arising from use of Yellow Fever Vaccine, Office of the Chief Surgeon, European Theater of Operations, U.S. Army, 1942.

Table 11

Incidence of Jaundice by Yellow Fever Vaccine Lots

North Ireland Forces

European Theater of Operations, U.S. Army

January to May 1942

Lot No.	No. Persons Vaccinated	No. Cases Jaundice	No. Cases Hospitalized	Attack Rate per 100
308	1	1	1	
317	102	1	1	1.0
319	1106	45	37	4.1
320	141	12	4	8.5
327	92	1	1	1.1
333	158	8	4	5.1
334	3	1	1	---
335	359	33	25	9.2
336	1	1	1	---
338	5512	519	393	9.4
346	1425	1	0	0.07
351	2550	68	37	2.7
353	3375	1	0	0.03
360	892	2	2	0.2
362	96	2	1	2.1
364	254	1	1	0.4
367	342	27	23	7.9
368	2181	235	170	10.8
388	22	3	3	13.6
Others*	9628	0	0	0
Unknown	3311	1	1	0.03
Total	31551	963	706	3.1

* Includes all vaccine lots with which Jaundice was not associated.
They are as follows:

33, 42, 65, 74, 104, 142, 216, 217, 232, 233, 237, 242, 251, 252, 268, 300, 301, 304, 309, 310, 315, 316, 318, 321, 324, 325, 326, 329, 330, 332, 337, 339, 340, 341, 342, 343, 344, 345, 347, 348, 349, 350, 352, 355, 357, 358, 359, 361, 363, 365, 366, 369, 370, 371, 372, 373, 375, 380, 381, 382, 383, 384, 385, 386, 387, 391, 392, 396, 397, 404, 423, 551, 643, 888.

Source: Interim report number 19, Homologous Serum Jaundice arising from use of Yellow Fever Vaccine, Office of the Chief Surgeon, European Theater of Operations, U.S. Army, 1942.

Table 12

Additional Yellow Fever Vaccine Lots
Found to be Associated with Jaundice in the
814th Engineer Battalion, England
European Theater of Operations, U.S. Army
23 May to 7 August 1942

Lot. No.	No. Inoc.	Jaundice Cases
91	9	2
331	195	15
340	17	1
369	5	1
370	59	1

Source: Interim Report Number 19, Homologous Serum
Jaundice arising from use of yellow fever vac-
cine, Office of the Chief Surgeon, European
Theater of Operations, U. S. Army, 1942.

Table 13

Correlation of Yellow Fever Lots and Incidence of Jaundice

North Ireland Force

European Theater of Operations, U.S. Army

Cases and Percent of Clinical Jaundice by Lot Numbers

January to May 1942

Vaccine Lot Number	Number Surveyed	Hospitalized Jaundice	Jaundice not Hospitalized	Sub-clinical infection	Not effected	Percent including Clinical Jaundice
317	9		5		4	55.6
319	90	4	11	16	59	16.7
327	11				11	-
333	1				1	-
338	361	35	55	34	237	24.9
339	1	1				*
340	42				42	-
342	5			1	4	-
345	1				1	-
347	16			2	14	-
350	1				1	-
351	326	6	35	21	264	12.6
352	1				1	-
353	11				11	-
361	1				1	-
362	6		2	1	3	33.3
367	5			2	3	-
368	383	20	36	51	276	14.6
382	1			1		-
388	1		1			*
423	20				20	-
Total rec'g know lots	1293	66	145	129	953	16.3
Unknown lots	238	5	4	5	224	3.8
Not inoculated	48	1	1		46	4.2
No record	15	5	1	1	8	40.0
Total	1594	77	151	135	1231	14.3

* Percent not significant.

Source: Preliminary report and Interim report number 13, Homologous Serum Jaundice arising from use of Yellow Fever Vaccine, Office of the Chief Surgeon, European Theater of Operations, U.S. Army, 1942.

Table 14

Correlation Between Date of Inoculation and Incidence of Jaundice

North Ireland Force

European Theater of Operations, U.S. Army

January to May 1945

Dates of Inoculations	Lot Number 338			Lot Number 368		
	No. Inoc.	No. Cases	Rate per 100	No. Inoc.	No. Cases	Rate per 100
January 1 - 15	3596	344	9.6	393	38	9.7
January 16 - 31	1046	106	10.1	48	3	6.3
February 1 - 15	14	---	----			
February 16 - 28	159	22	13.8	275	21	7.6
March 1 - 15	3	---	----	185	23	12.4
March 16 - 31	6	---	----	302	23	7.6
April 1 - 15	1	---	----	89	4	4.5
April 16 - 30				12	1	----
May 1 - 15				13	3	----
Inoculation dates unknown	687	47	----	864	119	----
Total	5512	519	9.4	2181	235	10.8

Source: Interim report number 20, Homologous Serum Jaundice arising from use of Yellow Fever Vaccine, Office of the Chief Surgeon, European Theater of Operations, U.S. Army 1942.

Table 15

Incubation Period of 298 Cases of Jaundice
by Yellow Fever Vaccine Lots

North Ireland Force
European Theater of Operations, U.S. Army
Number of weeks between inoculation and onset of symptoms
February to May 1942

Incubation Period in Weeks	Vaccine Lots										Total
	317	319	320	338	342	351	357	367	368	369	
5th									1		1
6th											
7th								2			2
8th						1			3		4
9th						7		1	5		14
10th						1		1	9		11
11th						1		1	19		21
12th				1		3		4	31		39
13th				1	1			5	23		30
14th						9		5	29		43
15th				1		5		6	23		35
16th			1	3		5	1	2	11		23
17th	1			3		2		4	7		17
18th		1		1		5		1	4	2	14
19th	1			1		3					5
20th	2			2		5			1		10
21st				4		4					8
22nd				3							3
23rd		2		3							5
24th		2				2			1		5
25th											
26th											
27th				4					1		5
28th									1		1
29th											
30th											
31st				1							1
32nd				1							1
Total	4	6	1	29	1	53	1	32	169	2	298

Source: Interim report number 22, Homologous Serum Jaundice arising from use of Yellow Fever Vaccine, Office of the Chief Surgeon, European Theater of Operations, U. S. Army, 1942.

Table 16
Effect of Other Immunizing Agents on Incubation Period of Jaundice
in Cases Who Received Yellow Fever Vaccine #368
Number of Days between Immunization and Onset of Symptoms

North Ireland Force

European Theater of Operations, U.S. Army

January to May 1942

Immunizations Within 20 Days Before or After Yellow Fever Inoculation	50 & Under	51-60	61-70	71-80	81-90	91-100	101-110	111-120	121-130	131-140	141-150	151-160	161-170	171-180	181-over	Total
Smallpox only		1	2	2	3	1			2							9
Typhoid only				3	2											7
Tetanus only	1	1	1	3	4	4	2	4		1						21
Typhoid & Tetanus				1		3	1									5
Smallpox & Tetanus	-	-	-	-	-	-	-	-	-	-						0
Typhoid & Smallpox				1		1										2
All Three: Typhoid, Tetanus & Smallpox		2			1											3
No Other Immunizations		2	8	20	30	32	16	10	1				1		2	122
Total	1	6	11	30	40	41	19	14	3	1	0	0	1		2	169

Source: Interim Report Number 21, Homologous Serum Jaundice arising from use of Yellow Fever Vaccine, Office of the Chief Surgeon, European Theater of Operations, U.S. Army, 1942.

Table 17

Jaundice Among Vaccinated and Unvaccinated Troops

European Theater of Operations, U.S. Army

Number of Cases by date of arrival in Northern Ireland

January to May 1942

Dates of Arrival	Vaccinated			Unvaccinated			Totals	
	Number	No. with Jaundice	%	Number	No. with Jaundice	%	Number	No. with Jaundice %
Jan 26	7,533	1	.01	3,379	8	0.24	10,912	9 .08
May 12	16,256	556	3.42	316	0	0	16,572	556 3.36
Casuals	1,388	0	0	12	0	0	1,400	0 0
Totals	25,177	557	2.21	3,707	8	0.22	28,884	565 1.96

Source: Interim report number 7, Homologous Serum Jaundice arising from use of Yellow Fever Vaccine, Office of the Chief Surgeon, European Theater of Operations, U.S. Army, 1942.

Table 18

Poliomyelitis

Total Army, Continental United States and Theaters of Operations, U. S. Army

Cases and rates per 1000 strength per annum

January 1942 to June 1945 Inclusive

Theater	Total		1942		1943		1944		1945	
	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate
Total Army	967	.05	48	.02	239	.04	350	.05	330	.09
Continental U. S.	420	.03	36	.01	167	.03	162	.04	55	.04
Total Overseas	547	.07	12	.02	72	.05	188	.05	275	.11
China-Burma-India	77	.23	3	.53	14	.30	35	.22	25	.21
South West Pacific	209	.17	0	.0	0	.0	39	.07	170	.44
Africa-Middle East	20	.15	0	.0	14	.26	5	.11	1	.04
Mediterranean	131	.10	0	.0	32	.07	61	.09	38	.16
Latin America	16	.05	4	.04	4	.03	5	.06	3	.08
Pacific Ocean Area	23	.02	0	.0	4	.01	6	.02	13	.06
North America	3	.02	1	.02	0	.0	1	.02	1	.06
European	68	.02	4	.06	4	.02	36	.02	24	.02
Alaska	0	.0	0	.0	0	.0	0	.0	0	.0

Source: Division of Medical Statistics, Office of The Surgeon General, War Department, Washington, D. C.

Table 19

Encephalitis
Total Army, Continental United States and
Theaters of Operations, U. S. Army
Number of Cases
January 1942 to June 1945 Inclusive

Theater	Cases
Total Army	387
Continental U. S.	320
Overseas	67
China-Burma-India	18
Pacific Ocean Area	17
South West Pacific	16
Mediterranean	6
Africa-Middle East	4
European	3
North America	2
Latin America	1
Alaska	0

Source: Division of Medical
Statistics, Office of
The Surgeon General,
War Department,
Washington, D. C.

Table 20

Tetanus

Total Army, Continental United States and
Theaters of Operations, U. S. Army

Number of Cases

January 1942 to June 1945 Inclusive

Theater	Cases
Total Army	13
Continental U. S.	10
Overseas	3
China-Burma-India	1
European	1
Mediterranean	1
Africa-Middle East	0
Alaska	0
Latin America	0
North America	0
Pacific Ocean Area	0
South West Pacific	0

Source: Division of Medical
Statistics, Office of
The Surgeon General,
War Department,
Washington, D.C.

Table 21

Scabies

European Theater of Operations, U.S. Army

Cases and Rates per 1000 strength per annum, by months

February 1942 to June 1945, Inclusive

Month	Total		1942		1943		1944		1945	
	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate
January	1461	5.44			103	9.41	383	6.23	975	4.98
February	1647	5.78	16	51.88	149	17.62	435	6.19	1047	5.08
March	2283	6.06	16	20.24	191	23.05	525	5.09	1551	5.86
April	1663	5.14	9	10.26	141	13.34	354	3.81	1159	5.30
May	1633	4.89	5	2.35	255	23.85	305	3.03	1068	4.82
June	1739	4.28	8	2.25	119	9.81	260	2.04	1352	5.13
July	428	3.18	23	3.59	216	11.30	189	1.74		
August	465	3.00	41	4.67	221	11.42	203	1.60		
September	502	2.51	20	1.58	186	7.97	296	1.81		
October	612	3.18	36	2.15	244	6.66	332	2.39		
November	819	4.00	26	2.33	223	5.44	570	3.74		
December	1334	4.43	40	4.29	335	5.15	959	4.23		
Total	14586	4.59	240	3.30	2383	9.02	4811	3.27	7152	5.22

Source: Division of Medical Statistics, Office of The Surgeon General, War Department,
Washington, D.C.

Table 22

Scabies

United Kingdom and Continent

European Theater of Operations, U.S. Army

Cases and Rates per 1000 strength, per annum by months
September 1944 to June 1945, Inclusive

Month	Total		United Kingdom		Continent	
	Cases	Rate	Cases	Rate	Cases	Rate
1944						
September	296	1.81	98	1.00	198	2.99
October	332	2.39	156	1.60	176	4.23
November	570	3.74	372	3.34	198	4.83
December	959	4.23	688	4.13	271	4.51
1945						
January	975	4.98	702	4.79	273	5.54
February	1047	5.08	787	4.96	260	5.50
March	1551	5.86	1257	5.87	294	5.82
April	1159	5.30	992	5.51	167	4.31
May	1068	4.82	934	4.87	134	4.48
June	1352	5.13	*	*	*	*
Total	9309	4.53	5986**	4.39**	1971**	4.64**

*Data not available.

**June 1945, not included.

Source: Division of Medical Statistics, Office of
The Surgeon General, War Department,
Washington, D.C.

Table 23

Scabies

Total Army, Continental United States and

Theaters of Operations, U.S. Army

Cases and Rates per 1000 strength per annum

January 1942 to June 1945, Inclusive

Theater	Total		1942		1943		1944		1945	
	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate
Total Army	65379	3.09	5532	1.81	15754	2.34	24388	3.25	19705	5.08
Continental U.S.	38498	2.93	4627	1.82	11625	2.26	13686	3.41	8560	5.92
Overseas	26881	3.34	905	1.76	4129	2.59	10702	3.06	11145	4.58
Mediterranean	7353	5.43	62	2.91	646	1.50	3821	5.79	2824	11.73
European	14586	4.59	240	3.30	2383	9.02	4811	3.27	7152	5.22
South America	822	2.36	60	.58	211	1.74	365	4.24	186	4.77
North America	365	2.15	46	1.14	101	1.41	112	2.66	106	6.85
Africa-Middle East	240	1.84	18	3.14	79	1.48	58	1.22	85	3.56
South West Pacific	2079	1.72	324	4.83	496	2.54	891	1.60	368	.94
China-Burma-India	444	1.34	0	0	24	.52	224	1.40	196	1.62
Pacific Ocean Area	838	.80	112	.76	146	.49	389	.99	191	.92
Alaska	154	.57	43	.86	43	.37	31	.37	37	1.58

Source: Division of Medical Statistics, Office of The Surgeon General, War Department,
Washington, D.C.

Table 24

Leprosy

Total Army, Continental United States and
Theaters of Operations, U.S. Army
Number of Cases, January 1942 to June 1945, Inclusive

Theater	Cases
Total Army	20
Continental U.S.	12
Overseas	8
Pacific Ocean Area	6
European	1
Mediterranean	1
Africa-Middle East	0
Alaska	0
China-Burma-India	0
Latin America	0
North America	0
South West Pacific Area	0

Source: Division of Medical Statistics, Office
of The Surgeon General, War Department,
Washington, D.C.

Table 25

Undulant and Malta Fevers

Total Army, Continental United States and

Theaters of Operations, U.S. Army

Number of Cases, January 1942 to June 1945, Inclusive

Theater	Cases
Total Army	485
Continental U.S.	358
Overseas	127
Mediterranean	70
Pacific Ocean Area	20
European	12
South West Pacific	7
Africa-Middle East	6
China-Burma-India	6
North America	3
Latin America	2
Alaska	1

Source: Division of Medical Statistics, Office
of The Surgeon General, War Department,
Washington, D.C.

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2. Jaundice following anti-leptic treatment.
3. The single case of tetanus in the European Theater of Operations.

A HISTORY OF PREVENTIVE MEDICINE
IN THE
EUROPEAN THEATER OF OPERATIONS
UNITED STATES ARMY
1941 - 1946

Part III - Epidemiology
Section 7 - Specific Immunization

by

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PART III

Epidemiology

Section 7 - Specific Immunization

The program of immunization for troops of the United States Army was prescribed by the War Department. Theaters of Operation had the obligation to execute these instructions in accordance with defined policy, making such alterations in schedule and method as were permitted by regulation in order to meet special situations. Immunization procedures were divided for administrative purposes into two classes, those termed routine immunizations and the special immunizations.

Troops arriving in the European Theater had in general received the four specified routine immunizations in advance of departure, since early published instructions directed that this be accomplished so far as time permitted. In many instances a number of the procedures were initiated or completed during trans-Atlantic transit, but a few had to be completed after the arrival of troops in the theater. Such special immunizations as were required of troops destined for Europe had almost invariably been completed before arrival.

A principal feature of the work of the Theater in immunization had to do with the development of an adequate system of survey and report on newly arrived units, to assure that primary immunization had been practiced in accordance with regulations. The work of the day was concerned with maintaining the status of immunity by reimmunization at the prescribed intervals.

From time to time, one or the other of the special types of immunization was required, ordinarily in connection with departure of troops for other theaters. Local situations occasionally required applications of such measures as immunization against diphtheria in selected groups. General theater wide surveys of the status of immunity of troops were undertaken under special circumstances, ordinarily associated with the mounting of a major military operation.

Immunization Activities in the European Theater.--The first directive on immunization was issued by the theater in May 1942. as a publication of the United States Army Forces in the British Isles. It supplemented the regulations of the War

Department which had governed from the time the Theater was established. Smallpox vaccination was prescribed for all officers and enlisted men who had not been protected within one year prior to leaving the Zone of the Interior for duty in the theater. A full course of typhoid paratyphoid inoculations was required under the same circumstances. Personnel who had completed the initial immunization for tetanus more than six months previous to departure for the theater were reimmunized by administration of one cubic centimeter of tetanus toxoid. The three doses of the initial inoculation were required for those having no record of previous treatment.

In early July the War Department prescribed typhus vaccinations for all military personnel stationed in or traveling through the British Isles.

The existing requirements of the War Department in respect to tetanus were stated in detail in one of the initial orders of the newly established European Theater of Operations, published in July of 1942. Reimmunization at a six month interval was required as in the previous order.

Preparation for Operation TORCH.-- The departure of an expeditionary force from the European Theater to North Africa, designated Operation TORCH, led to the publication of the first comprehensive immunization order of the theater. In preparation for that event, unit commanders were directed in early September 1942 to assure that military personnel of their commands were properly protected against typhus, typhoid and paratyphoid fevers, smallpox and tetanus. A series of weekly reports was required of all units, noting the current progress attained in bringing the status of members of the command to complete protection.

Indicative of the difficulties in communications and in the circulation of orders that existed at that time, separate instructions were issued to troops of the Services of Supply; and to medical organizations of the command from the Office of the Chief Surgeon, in addition to the general theater order. The important consideration was that troops departing for Africa be assured of full protection.

For security reasons it was considered unwise to check only on the status of immunization of those units intended for active operations in the immediate future, since a clear indication of the strength to be employed could thereby be determined. Complete immunization of all troops was under any circumstances a desirable objective. A theater wide effort was consequently put into effect.

Troops having no record of the complete and initial immunization against typhus fever received three injections of typhus vaccine at weekly intervals. Those who had completed the initial series of three doses one year or more previously received a stimulating dose of one cubic centimeter of typhus vaccine.

In respect to typhoid and paratyphoid fevers, persons having no record of a completed initial immunization within three years received three injections at weekly intervals. Those who had completed the initial series one year but not more than three years previously received a stimulating dose of 0.5cc of typhoid-paratyphoid vaccine.

Personnel having no record of a completed initial immunization against tetanus received three doses at tri-weekly intervals. Those who had completed the initial immunization or received a stimulating dose more than four months previously received an additional stimulating dose of one cubic centimeter of tetanus toxoid.

Troops were revaccinated where no record was available of successful vaccination against smallpox within one year. North Africa had a well earned record for outbreaks of smallpox and revaccination within a one year period was deemed desirable.

The directions in respect to typhus fever and typhoid-paratyphoid fevers were in accordance with standard practice. The additional requirement in respect to tetanus was prescribed because the troops were entering a combat area. The assurance of the efficacy of active immunization against tetanus which came with later experience did not exist at this time, and every reasonable precaution was deemed advisable. The action taken was in line with the policy of reimmunizing troops against the disease just prior to departure from the Zone of the Interior for a theater of operations. The troops were leaving one theater for another.

The first weekly report required by this program gave indication of the extent to which troops of the theater were properly immunized. For a representative sample of the theater population, protection against typhus existed in the proportion of 84.3%; for typhoid and paratyphoid fevers, 89.2%; for tetanus 80.9%; and for smallpox 89.3%. Subsequent weeks saw measurable progress in the approach to complete immunization. Special letters were sent in October to units that were particularly delinquent. By the end of the year when this special effort was concluded the extent of immunization against typhus had reached 97%, against typhoid and paratyphoid 99%, for tetanus 96%, and for smallpox 98%. Individual

unit reports gave information that the level of accomplishment for the Ground Forces was better than that for the theater as a whole. Very few individuals of the task force left for duty in North Africa without adequate and complete protection against the diseases of that area for which specific immunization procedures existed.

Periodic Survey of Immunization Status.--Having met the special circumstances associated with the departure of the task force for Africa, theater regulations in respect to immunization against tetanus were promptly altered to require that those who had completed the initial immunization series, were henceforth to receive a stimulating dose of one cubic centimeter at the end of each twelve-month period.

When somewhat more than six months had elapsed after the energetic immunization effort of late 1942, the attention of commanding generals of all major commands was brought to the very satisfactory situation which had existed at that time, together with a statement that the need continued and that maintenance of a proper immunization status of the army was as essential as primary immunization. A periodic check was ordered to assure compliance with theater requirements.

Meanwhile in the Zone of the Interior greater effort was extended to assure that troops arrived in the theater completely immunized. That conditions had measurably improved since the early days of the theater was shown by a special field survey instituted in April 1943 of ten newly arrived Air Force and Services of Supply units. Actual inspection of immunization records, including those of a group of officers, showed the prescribed immunization against smallpox; typhoid fever and tetanus to have been completed with few exceptions before embarkation, and that immunization against typhus had in general been completed enroute. Immunization of very few men remained to be done after arrival in the theater. A further investigation two months after arrival showed the same ten organizations which included 1305 officers and men, to be completely immunized in accordance with theater requirements against typhoid fever, tetanus and typhus fever, and only one man was not immunized against smallpox.

The 3rd Armored Division was selected for similar studies. Shortly after debarkation in September, 1943, the immunization records of 1,032 men were examined. All were completely immunized against tetanus and smallpox. One lacked typhoid fever protection and two were deficient in respect to typhus fever, altogether an enviable record.

Immunization Order of 1943 - Routine and Special Procedures.--Various procedures relating to immunization such as the recording of injections against tetanus on identification tags and other alterations which had been made since publication of the original immunization circular in September 1942, were brought together in a new publication in September 1943.

The requirements for the four routine immunizations were re-stated, together with the special requirements for persons entering particular geographic areas and for the protection of members of the command under special circumstances. This included the measures for specific immunization against yellow fever, cholera, plague and diphtheria.

Preparations for the Invasion of Normandy.--Just as had been done in connection with the mounting of Operation TORCH in Africa, plans were made and early action taken in the course of mounting Operation Overlord in Normandy, to make certain that the troops sent were thoroughly protected against the communicable diseases for which protective measures were necessary.

Accordingly, a special letter was published by theater headquarters under date of 7 February 1944, directing that all officers and men who had not been immunized or reimmunized against tetanus since 1 February 1944 would receive a stimulating dose; and that all who had been vaccinated or revaccinated against typhus fever, typhoid-paratyphoid fever, and smallpox prior to 1 July 1943 would similarly be reimmunized.

This program served to bring about a situation where members of the command entering Normandy in June were protected against the last three diseases within one year and against tetanus by an immunization no more distant than six months. The results that were attained, as judged by a special survey and report, matched those of the previous experience in preparation for Operation TORCH. The status of immunization was nearly perfect.

Immunization Practices on the Continent.--Among the significant changes incorporated in the next revision of immunization requirements, which again came after about a year, was a change in the requirements governing vaccination against smallpox. The interval between revaccination was increased from one year to three years. Altered requirements for yellow fever vaccination which had been stated already in a special order were incorporated into the new general order in somewhat greater detail. For the first time provision was made for immunization of prisoners of war. Vaccination against smallpox

and the typhoid-paratyphoid fevers as prescribed for forces of the United States Army, was made mandatory except when documentary proof in the form of official records showed previous compliance.

By the following January of 1945 the War in Europe had advanced to what gave good evidence of being its final stages. No great number of new troops was being received from the Zone of the Interior. The form of the European Theater had settled down to the semblance of a fixed force well on the way to the accomplishment of its mission. It was therefore believed reasonable to relax some of the previously existing requirements for specific protection against the communicable diseases. The principal change was in respect to administration of tetanus toxoid. The requirements of an annual revaccination were liberalized to the extent of requiring only the original series, revaccination after the first year and thereafter a stimulating injection only in case of battle wounds or in the other specially prescribed situations which had always governed.

Immunization during Redeployment.--The final revision of practices in specific protection was brought into force in May of 1945, largely to meet new situations which had developed after the war and to provide for new problems in connection with redeployment,

Persons traveling to the United States were required to meet theater provisions for protection against the four routine diseases, (smallpox, typhoid-paratyphoid fevers, typhus fever and tetanus) and for yellow fever when the returning travel to the Zone of the Interior involved passage through the prescribed yellow fever zone.

For military personnel proceeding to other theaters, smallpox vaccination within one year of departure from the theater was obligatory. A single stimulating dose of typhoid-paratyphoid fever vaccine was required within one year of departure and likewise a stimulating dose of tetanus toxoid when no previous stimulating dose had been received. Reimmunization against typhus fever must have been within one year. The usual regulations applied in respect to yellow fever. In addition all persons traveling to or through any part of Asia or the Pacific Ocean area were immunized against cholera.

The particular features relating to protection against the individual communicable diseases for which specific immunization is available, are summarized in Table 1, as represented by Theater procedure in 1945. The changing practices which occurred in the

course of operations in respect to the individual diseases will now be briefly outlined.

Smallpox Vaccination.--For the first two and a half years of theater activity, annual revaccination against smallpox was practiced. Operations were mounted in the autumn of 1942 and in the spring of 1944. It was deemed advisable to send troops into action with immunization against this disease no more than one year remote. Specific troop commitments could never be determined with certainty and consequently the practice was made universal. When operations on the European continent were finally under way, the requirement was relaxed through return to the standard practice of revaccination at intervals of three years. Troops arriving from the Zone of the Interior could be depended upon to have been revaccinated within one year.

Typhoid Fever Immunization.--Annual revaccination against the typhoid and paratyphoid fevers was a continually maintained policy of the theater. The practice in vogue in the Army for many years of requiring a complete series of typhoid-paratyphoid vaccine every three years continued to hold through the early months of the theater. Subsequent to September 1943, a single initial series of three doses met all requirements, whenever given, and annual reimmunization was accomplished by administration of 0.5cc of vaccine. The only exception came in preparation for the Normandy invasion, when the immunization requirements for that operation were arranged in such a way that every man entering the European campaign would have been immunized against typhoid fever not less than one year previously. To accomplish this and at the same time fit the immunization program into the mounting plans for the operation, the interval in some instance was then as short as six months.

Immunization Against Typhus Fever.--Specific immunization against typhus fever was first directed by the War Department for the European Theater in the summer of 1942. (Figure 1) The practice was incorporated in theater directives issued in September of that year. Originally the series of primary injections involved three successive doses, which continued to be the required procedure until 7 January 1945, when improvements in the antigenic quality of the immunizing agent made possible a change to a series of two.

Annual reimmunization with 1 cc. was continuously in practice until the special requirements of February 1944 in preparation for the continental campaign. This led in some instances to reimmunization at as short an interval as six months.

The demonstrated presence of typhus fever on the European continent and the prospect of greatly increased numbers of cases among the civilian population as troops approached Germany, gave rise to a special problem in late 1944. The requirements of the War Department were that immunization should be practiced in November and again in February for troops operating in a typhus infested region. In the autumn of 1944, troops of the theater were not operating in a typhus infested region. There was no typhus fever in France. Troops of the armies would almost certainly be in a typhus region by late winter or early spring. Decision was taken to administer typhus vaccine about the middle of December, in the hope that a single dose given then would suffice for the epidemic season. The program was completed by 20 December 1944. In the event of a serious typhus situation in Europe, a second general immunization was to be brought about in March or April. Provided the situation continued favorable, no further reimmunization with typhus vaccine was to be done.

March came, and it was decided not to proceed with further immunization. No cases of typhus fever had occurred among American soldiers. The Army was operating in a typhus infested region but control measures were proving efficient in limiting the spread of the disease.

Individual units such as those responsible for control measures against typhus fever in civilian populations, and others exposed to special hazard were reimmunized every 3 months; but no general immunization of troops of the theater was undertaken. The record of only three cases of typhus fever among American soldiers, two of them among recently reimmunized persons engaged in the control of the disease, served to support this decision.

Immunization Against Tetanus.--The primary immunizing series against tetanus always included three subcutaneous injections of 1 cc. of tetanus toxoid at three-week intervals. An emergency stimulating dose of 1 cc. was administered as soon as possible after injury to individuals receiving wounds or severe burns, or when deemed advisable by the responsible medical officer, to those undergoing secondary operations or manipulations of old wounds.



Figure 1.

Immunization of combat troops against typhus fever, Germany,
December 1944.

Reimmunization underwent periodic changes in practice. In preparation for operation TORCH reimmunization within the preceding four months was required. Reimmunization in connection with operation OVERLORD was so timed that all troops of the command had received a stimulating dose of tetanus toxoid within approximately six months of D-Day. Other than for those two special events, annual reimmunization was practiced until 7 January 1945. A single stimulating dose following the original series after one year, was thereafter the only requirement. In view of experience which demonstrated so certainly the efficacy of active immunization against tetanus, less frequent reimmunization would have sufficed, and in all probability have given a record of protection equally good.

In the conduct of medical affairs in the European Theater American soldiers were frequently admitted to British hospitals and British soldiers to American installations. The United States Army was committed to a program of prevention of tetanus through the use of tetanus toxoid. In the event of wounds or other need for immediate protection, a stimulating injection of toxoid was administered. Tetanus anti toxin was not used.

The British services placed reliance on tetanus anti toxin in the prevention of tetanus infections. Because of a lack of primary stimulus on the part of British soldiers, immediate and certain protection could not be afforded by administration of toxoid. On the other hand, it was not desirable that American soldiers receive tetanus anti toxin when admitted to British hospitals. Because no common program was possible, an order was published directing that British soldiers admitted to American hospitals were to be treated by the British method for prevention of tetanus, and that American soldiers admitted to British hospitals were to have American style prevention.

Yellow Fever Immunization.--Immunization against yellow fever was required of all military personnel, and all civilian employees subject to field service with the army, and all others authorized to travel by United States water and air transport before entering or passing through areas in Africa between 18° south latitude and the northern border of French West Africa, French Equatorial Africa and the Anglo-Egyptian Sudan, including the immediately adjacent islands. Areas in South America included those between 13° north latitude and 30° south latitude, including the islands immediately adjacent, and Panama, including the Canal Zone. Yellow fever vaccination was not required when entry into the Canal Zone was only for transit through the zone.

Immunization had to be completed not less than 10 days and not more than four years before entry into the areas defined. Air transport command, port and immigration authorities required evidence of completed immunization against yellow fever from individuals traveling through the areas specified. A properly executed War Department MD Form 81 or a certified true copy was judged to satisfy this requirement.

The initial immunization consisted of the administration of 0.5cc. of yellow fever vaccine, and stimulating doses were required at intervals of four years.

Cholera Vaccination.--Immunization against cholera was required of individuals traveling through or stationed in Asia, including the Middle East, the Southwest Pacific Area and the East Indies. Two subcutaneous injections of 0.5cc. and 1 cc. of vaccine respectively, constituted the initial series of immunizations when given at weekly intervals. A stimulating dose of 1 cc. was required at 4 to 6 month intervals in the presence of danger of cholera.

Diphtheria Immunization.--The immunizing agent for this disease was plain diphtheria toxoid. No routine program of immunization was practiced in the theater. The use of the immunizing agent was authorized when the occurrence of diphtheria among troops was of such nature as to give indication of likely spread. It was recommended that large scale administration of diphtheria toxoid should be undertaken only in the presence of sound epidemiologic evidence. Large scale Schick test surveys for the determination of susceptibility to diphtheria were not considered practicable. A preliminary reaction test dose of 0.1 cc. of plain toxoid administered subcutaneously was advised. Individuals who demonstrated no untoward response within 48 hours were started on the regular immunization schedule. The initial series of immunizations thus consisted of individual doses of 0.1 cc., 0.5 cc. and two doses of 1 cc., with a period of 48 hours between the first and second doses and 3 to 4 weeks for the others. Subsequent stimulating injections were not ordinarily given. The frequency of diphtheria in the European Theater during the course of active operations was so slight that relatively little active immunization against this disease was practiced. It was used by some few hospital units. The best available records indicate that diphtheria immunization was never used by Air Force or Ground Force troops.

Plague Immunization.--Provision existed for protection of soldiers against plague. The vaccine was never used for

troops stationed in the theater because plague never appeared. Persons departing for other theaters, particularly to the Far East, were in some instances immunized against plague before departure but in general it was recommended that this measure be postponed until arrival in the theater to which personnel were dispatched. The indication for plague vaccine was stated as a serious threat of exposure to epidemics of that disease. Primary immunizing series consisted of two subcutaneous injections of 0.5 cc. and 1 cc. respectively, at weekly intervals. Stimulating doses were necessary for continued protection against plague, and ordinarily 1 cubic centimeter at six month intervals was deemed to suffice in the presence of danger from that disease.

Reactions to Immunizing Agents.--The theater was singularly free of any serious reactions to the immunizing agents administered, either routinely or for special purposes. The usual reactions that follow administration of these agents occurred in about the usual expectancy.

Untoward results associated with administration of tetanus toxoid involved a group of 219 men who received stimulating doses in January 1943. Thirty-six of the men experienced reactions of an allergic nature, including varying degrees of local edema, asthma, localized and generalized urticaria, fever, headaches, nausea, and vomiting. The identity of these symptoms, as well as the combination of two or more symptoms, varied widely in individual cases and hospitalization was required for only six. The symptoms appeared five to nine days after reinjection and were readily relieved by administration of epinephrine. The initial series for most of the men had been completed 4 to 6 months previously. The difficulty came with the first reimmunization. The absence of local suppuration and cellulitis precluded laxity in surgical technic.

The only other instance of reported reactions to tetanus toxoid involved a different type of clinical manifestation, namely an immediate effect. A majority of the men developed an immediate local reaction but not all; no delayed reactions occurred. A primary irritant, either the toxoid itself or some preservative, was suspected.

The severity of the reactions which followed administration of diphtheria toxoid in the adult population of the army were usually of such degree as not to encourage extensive use of the agent.

The widespread incidence of homologous serum jaundice following administration of yellow fever vaccine which occurred

during the early days of the theater, is discussed separately and in connection with epidemic hepatitis.

Supplies of Immunizing Agents.--With two exceptions, biologic products of American origin were used entirely in accomplishing the program of immunization in the European theater.

Throughout the course of operations smallpox vaccine prepared by the Government Lymph Establishment of the United Kingdom was employed in the protection of American troops. Arrangements were made with the Ministry of Health to supply the materials. Requisition was made through American installations but the vaccine was shipped directly to units by the Government Lymph Establishment. This arrangement provided an admirable solution to the difficult problem of maintaining a constant and satisfactory immunizing agent for theater needs.

Results of the Immunization Program.--No better index can be obtained of the satisfactory accomplishments of specific protective immunization than by consideration of the frequency of the four principal diseases toward which the program was directed. No case of smallpox occurred in the theater. Only three soldiers contracted typhus fever, of whom two were subjected to special risk through duties involved in the care of patients. Tetanus was a remarkably rare disease, out of all proportion and comparison with the experience of previous wars. Typhoid and paratyphoid rates set an all time record for the United States Army. The results are shown in Table 2.

Table 1

IMMUNIZATION PROCEDURE IN THE EUROPEAN THEATER OF OPERATIONS

May 1945

Routine Immunizations (All Personnel)			
Disease & Agent	Initial Immunization	Stimulating Dose	
Smallpox (vaccine)	Vaccination on entry	Vaccination every 3 years	
Typhoid-paratyphoid fevers (triple vaccine)	3 subcutaneous injections of 0.5 cc, 1 cc and 1 cc, respectively, at weekly intervals	0.5 cc yearly	
Typhus fever	2 subcutaneous injections of 1 cc, each, at weekly intervals	1 cc yearly, preferably about 1 Dec.*	
Tetanus (plain toxoid)	3 subcutaneous injections of 1 cc, each, at 3 week intervals	1 cc one year initial series**	
Special Immunizations - Required for certain areas			
Disease & Agent	Indication	Initial Immunization	Stimulating Dose
Cholera (vaccine)	Travel or station in Asia (including Middle East), the Southwest Pacific area, and East Indies	2 subcutaneous injections of 0.5 cc and 1 cc, respectively, at weekly intervals.	1 cc at 4 - 6 months intervals in the presence of danger of cholera
Yellow fever (vaccine)	Before entry into or passage through yellow fever zones.	0.5 cc	Every 4 years

Table 1 (cont'd)

Indicated in the Presence of Definite Disease Hazards			
Disease & Agent	Indication	Initial Immunization	Stimulating Dose
Plague (vaccine)***	Upon serious threat of exposure to epidemic	2 subcutaneous injections of 0.5 cc and 1 cc, respectively at weekly intervals	1 cc at 6 month intervals, in the presence of danger of plague
Diphtheria (plain toxoid)***	Occurrence of disease among troops, with indications of likelihood of spread	0.1 cc, 0.5 cc, 1 cc & 1 cc; 48 hours between 1st & 2nd doses; 3 to 4 weeks for remainder	Usually none

* An additional dose of 1 cc of typhus vaccine should be administered every 3 - 6 months in the presence of serious danger of infection.

** An emergency stimulating dose of 1 cc of tetanus toxoid will be administered, as soon as possible after injury, to individuals receiving wounds or severe burns, and, when deemed advisable by the responsible medical officer, to those undergoing secondary operations or manipulations of old wounds.

*** Large scale administration of diphtheria toxoid or plague vaccine should be undertaken only in the presence of sound epidemiological evidence therefor.

Source: Circular No. 68, Hq. European Theater of Operations.
25 May 1945.

Table 2

SPECIFIC PREVENTION OF INFECTIOUS DISEASES BY IMMUNIZATION
European Theater of Operations, U. S. Army
Cases per 1000 strength, per annum
February 1942 to June 1945, Inclusive

DISEASE	TOTAL	1942	1943	1944	1945
Smallpox	0	0	0	0	0
Typhoid and Paratyphoid	62	1	2	27	32
Tetanus	1	0	0	1	0
Typhus*	5	0	0	0	5
TOTAL	68	1	2	28	37

Source: Division of Preventive Medicine, Office of the
Chief Surgeon, European Theater of Operations.

*Includes two American RAMPS (Recovered Allied Military Personnel).

FIGURE

1. Immunization of combat troops against typhus fever, Germany, December 1944.

TABLES

1. Immunization procedure in the European Theater of Operations, May 1945.
2. Specific prevention of infectious diseases by immunization, European Theater of Operations, U. S. Army, Cases per 1000 strength per annum, February 1942 to June 1945, inclusive.

A HISTORY OF PREVENTIVE MEDICINE
IN THE
EUROPEAN THEATER OF OPERATIONS
UNITED STATES ARMY
1941 - 1945

Part III - Epidemiology
Section 8 - Foreign Quarantine

by

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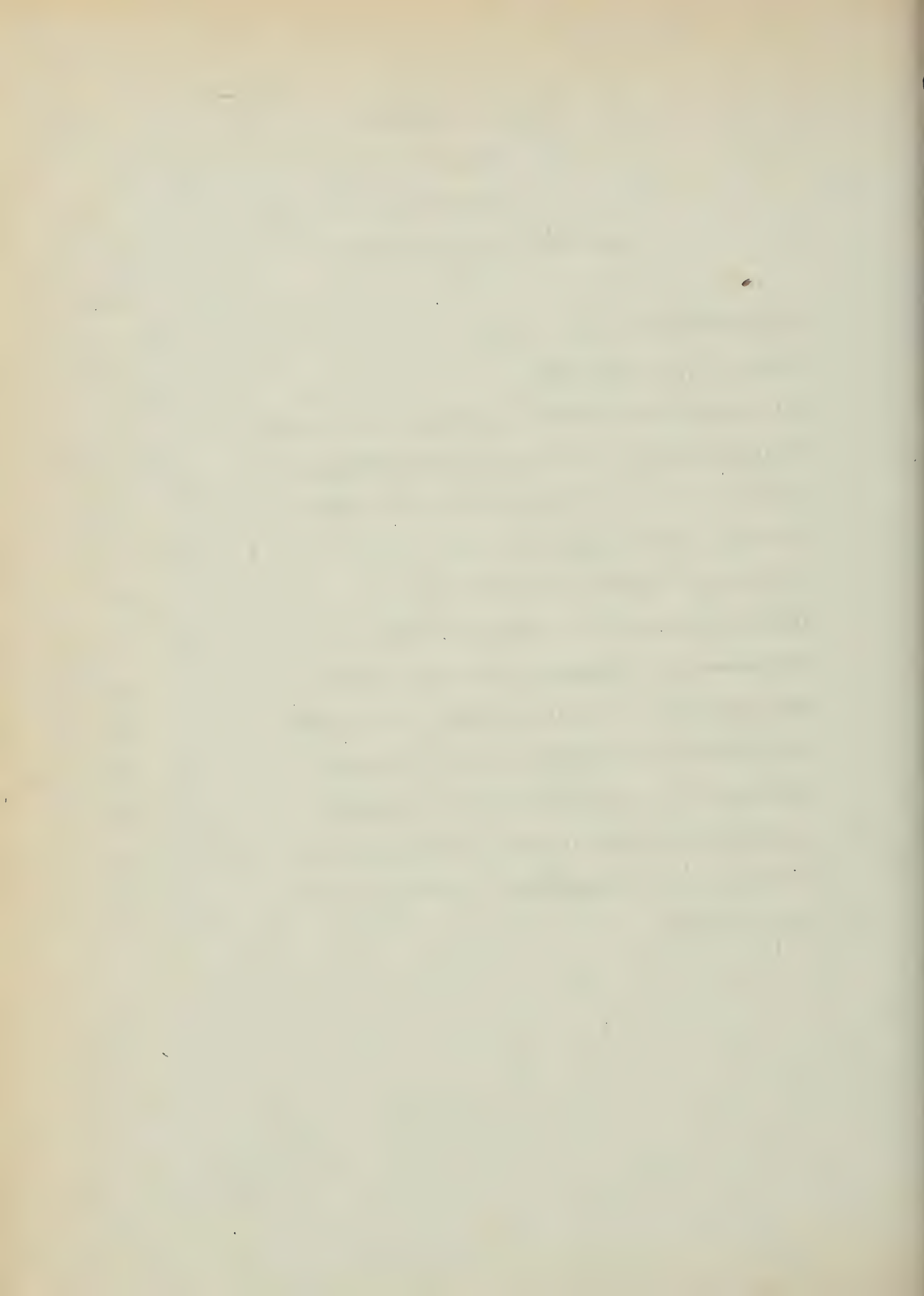
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PART III

Epidemiology

Section 8 - Foreign Quarantine

Foreign Quarantine.--Foreign quarantine in military practice in the European Theater involved the protection of outgoing and incoming passengers. The great proportion of movements in international traffic naturally involved personnel of the United States Army but some of the most complex problems were associated with others who travelled under United States military auspices.

Prominent among these were members of the American Red Cross, technicians of various kinds but mainly those employed by the air forces, technical experts, scientific advisers, diplomats and members of the Allied armed forces. As the war developed there were obligations relating to the transport of other nationals, the French, Belgians and Dutch, and at times the movement of large bodies of allied troops as when the 1st French Army came from North Africa. As the war ended, the flow of traffic was reversed; and there was need to protect the Zone of the Interior and other areas of redeployment from importation of diseases from the theater. The principal effort previously had been to assure protection of the theater.

While the work was essentially that of foreign and port quarantine as ordinarily understood, it was much broader in its interests and outlook, for all of the features of sanitation and health as related to overseas troop movements and the management of ports came into consideration.

Sanitary Control of Ports.--From the time operations began in the United Kingdom, the control of sea traffic entering British ports was a function of the local British Port Authority at the various ports of entry. British quarantine procedure differed from that in America where the control of maritime traffic is at the Federal level and actual practice is by the United States Public Health Service. The Ministry of Health in Great Britain acts in an advisory capacity and promulgates certain general policies, but the actual management of quarantine and other sanitary practices in ports is a direct obligation and function of the particular local port authority.

Port battalions of the United States Army Transportation Corps were early established in all of the principal ports of the United Kingdom to which American ships came. They served in

facilitating the reception of United States troops as they arrived in Great Britain and dealt with matters concerning the United States War Shipping Administration and the merchant marine under United States flag. A port surgeon was a part of the organization.

Under the arrangements in effect during the early months of the theater the management of quarantine and the inspection of ships and newly arrived troops followed the usual procedure of British ports, in that the local British Medical Port Authority exercised control and jurisdiction. Port surgeons of the United States Army had neither duties nor responsibilities associated with quarantine or medical reception.

Since the personnel of British Port Authorities had suffered the usual depletions and shortages in staff that characterized most organizations in time of war, American port surgeons were gradually delegated authority by a number of British Port Authorities. Although the latter continued to retain primary responsibility in health and other matters, a working arrangement commonly evolved whereby duties relating to American troop transports and much of that of cargo ships of American registry or control, was done by the American Port Surgeon acting for his British counterpart.

The sanitary practices of the several ports of embarkation varied considerably because each port functioned under an independent and separate local authority, and because the individual arrangements made between British and American port surgeons of a given port were different. Nevertheless the system worked fairly satisfactorily.

The sanitary difficulties in connection with a series of outbreaks of diarrheal disease on incoming transports in September 1943 (see page 23, Part III, section 2, number 1), led to a general reconsideration and evaluation of port practices and sanitary control of troop movements on both sides of the Atlantic. The measures taken in the Zone of the Interior have been described.

The theater made a comprehensive survey of port practices at the receiving end. With due allowances for the variations in practice which made each port an individual problem, a general pattern of procedure characterized practices at the 4th, 5th, 11th, 12th, and 14th Ports of Embarkation.

When a transport of American registry came into a port in the United Kingdom, the ship surgeon or transport surgeon cleared the vessel through quarantine in company with the civilian medical officer of health of the port. In the event that patients with

infectious disease were aboard ship, the civilian port medical officer took complete control where necessary and sent the patients to British civilian fever hospitals. The American port surgeon arranged for evacuation and hospitalization of soldiers requiring care for other than a communicable disease.

The arrangements by both British and American port surgeons were made on the basis of information provided by the transport surgeon. There was no inspection or examination of arriving troops. According to statements obtained from commanding officers of recently arrived units, no examination and no inspection was ordinarily held aboard ships in transit; and in the opinion of port surgeons such inspections were rarely if ever held. The statements of unit surgeons arriving in the theater indicated that the pre-embarkation physical inspection in ports of the Zone of the Interior was likewise decidedly cursory.

On the basis of these observations, steps were taken to more clearly define the duties of Port Surgeons in United States ports of embarkation in the United Kingdom, and to bring them into agreement with the provisions of existing army regulations. The practice of sending United States soldiers to civilian fever hospitals was a matter of necessity in the early days of the theater but adequate U.S. Army hospitals were later located near all principal ports. Loose practices had developed in respect to naval gun crews and merchant seamen. They were often allowed shore leave with communicable disease, particularly a venereal disease, a practice which had given rise to informal inquiry and comment by British health authorities.

Other than the Medical Department of the United States Army, four other organizations within the theater area were concerned with an attempted stabilization and organization of sanitary practices in ports. First of all was the British Ministry of Health and the several British Port Health Authorities having local jurisdiction. The United States Navy was definitely concerned. A great proportion of port activities related to the American Merchant Marine, and the War Shipping Administration. The definite management of port activities as they related to American interests was the obligation of the Transportation Corps of the United States Army.

Joint British and American Agreement on Port Control.--

Since the control of maritime traffic in British ports was wholly a function of British authority and the United States Army to all intent and purpose was a guest user of those facilities, the first thing to do in any proposed development of American control of American port activities was to obtain sanction of British authorities

to that proposal. The British Ministry of Health proved most sympathetic and indeed welcomed American aid in the work of inspection and control.

The Ministry wrote all local port authorities concerned, recommending that sanitary control of American shipping be delegated to American port authorities who would act for the local port health authority, although the latter would continue to maintain primary responsibility. The willingness of United States port control organizations to accept this obligation was assured. Without exception all local port authorities agreed to the suggested arrangement and expressed appreciation of the technical additions to port control facilities which would follow.

The possibility of such an arrangement having been assured, the Transportation Corps of the United States Army gave ready agreement to the projected system, believing that it would improve practices and facilitate the work of ports. A letter was sent by the Chief of Transportation to all Port Battalions of the United States forces in Great Britain asking for a statement of existing practices and duties of port surgeons.

On the basis of the replies received, a protocol of port procedure was prepared by the Division of Prevention Medicine of the Office of the Chief Surgeon, based on existing common and desirable practices and including the necessary alterations to eliminate undesirable features demonstrated by the original survey. The authority of port surgeons and their relations with British port authorities were defined.

A conference of United States port surgeons served to bring into line with the practical aspects of ship inspection and the sanitary control of ports the desired objectives and the tentative provisions of the proposed regulations. On the basis of this preliminary planning and the working arrangement which had been effected through the help of the Ministry of Health, a draft of provisional procedure was prepared and submitted for consideration of the United States Navy.

The Navy was particularly interested in that most transports carried naval gun crews. Naval surgeons were not stationed in all ports used by American transports. Furthermore, a single inspection of a ship and its personnel had advantage over a duplicating inspection by both Army and Navy port surgeons in expediting the clearance of vessels. The Army agreed to accept entire responsibility and that arrangement was finally agreed upon for all transports carrying United States Army personnel, the Navy naturally continuing to exercise full responsibility over purely naval vessels.

The arrangement with the American Merchant Marine produced greater difficulty. In general, previous practice had been looser and less satisfactory for cargo ships than for transports. It was agreed that the Army would be responsible for certification of health conditions of all transports carrying troops. Many cargo vessels carried small numbers of military personnel, sometimes only three or four, and it was necessary to define just what a transport was; whether it was any vessel carrying a member of the United States Army or whether certain numbers of persons should determine the decision. It was finally agreed that the international definition of a passenger vessel should govern, namely that the presence on board a ship of more than 16 passengers should determine its nature as a troop transport.

The Army Medical Department in initiating these discussions had offered to provide the same services of inspection and sanitary control for cargo vessels of American registry or control, as for transports carrying United States troops. This arrangement was declined by the Merchant Marine, since the less rigorous inspection of the domestic civilian port authority was believed to be the only workable procedure.

Sanitary Control of Ports in the United Kingdom.--Eventually the varying interests of the several military and civilian organizations of both British and American origin were correlated and a directive on the sanitary control of ports was issued with the indorsement of all concerned. The responsibility for granting pratique to all ships entering ports in Great Britain and Northern Ireland was stated to rest with the civilian port health authority, who through mutual arrangement might delegate this responsibility to the United States Port Surgeon. The conditions under which this was to be accomplished were set forth in detail. The closest liaison and cooperation was directed to be exercised at all times by United States port surgeons with civilian port medical authorities.

Certain terms pertaining to maritime traffic were defined. A transport was to be considered as any vessel carrying in overseas movement 17 or more military personnel as passengers. A cargo ship was any other vessel in overseas traffic, except hospital ships and naval vessels. Hospital ships were to be considered as those carrying principally sick and wounded military personnel.

An official list of communicable diseases was set forth which included all of the venereal diseases. Quarantinable diseases were stated to be those recognized by the International Sanitary Convention, to include typhus, yellow fever, small pox, plague and cholera.

The definition of military personnel was to be understood as including all members of the United States Armed Forces and others such as American Red Cross employees and civilian technicians traveling prote[m] under military control.

Regulations were first prescribed for procedures to be followed in the reception of troop transports. The passenger branch of the operations division of the Port Battalion was to notify the port surgeon in writing of the expected date and hour of arrival of each transport bearing United States military personnel, regardless of flag of registry, as soon as the information was available. The port surgeon or his representative was required to board each incoming transport most expeditiously.

Upon boarding the transport, the port surgeon or his representative reported to the transport commander or his designated representative. He received from the transport surgeon a list of the sick and wounded aboard, by name, army serial number, organization, provisional diagnosis and recommended disposition. He received the voyage report of the transport surgeon and a certificate of the immunization status of troops aboard. The transport surgeon also provided a copy of the ship's roster endorsed with the statement that except for certain individuals specifically noted the ship's company, including troops, crew, and United States naval gun crew, was free from vermin and communicable disease. In the event the transport surgeon was being relieved from duty on completion of the voyage, a record of alcohol and narcotic receipts and expenditures was audited.

The port surgeon initialed each page of the roster certifying to the health of the ship's company and their proper physical examination. If no physical examination of troops and ship's company had been made during the voyage, the port surgeon caused such an examination to be made without delay. If the physical inspection had not been done within 48 hours of debarkation, he made or caused to be made such examination or inspection as he deemed necessary. Only those members of the ship's crew or naval gun crew or other military personnel whose names were certified on the roster were permitted to disembark.

Immediately a transport carrying United States military personnel had docked, the port surgeon made a sanitary inspection of the ship with particular reference to the care of the sick, hospital accommodations, medical supplies, available sleeping and latrine facilities, messing accommodations, mess sanitation and the quality of rations provided.

The surgeon arranged for the reception and care of military personnel unfit to travel and for the hospitalization in the most convenient United States military hospital of those who were sick and injured, except that members of the ship's crew with uncomplicated venereal disease were allowed to remain aboard but not to disembark.

The port surgeon quarantined on the duly delegated authority of the civilian port Medical Officer of Health and pursuant to the procedure established by the International Sanitary Convention any ship bearing aboard a diagnosed or reasonably suspected case of typhus, yellow fever, smallpox, plague, or cholera and promptly notified the Chief Surgeon of the European Theater. Quarantine, fumigation, or other procedures which might delay the movement of the vessel were not practiced for other communicable diseases except on specific order of the Chief Surgeon, ETOUSA.

Upon receipt of prisoners of war or of military personnel from an area in which typhus fever was prevalent, the port surgeon carried out the necessary desinfestation procedures and certified that proper disinfestation had been accomplished.

In the event of the reception of a ship bearing cerebrospinal fever, diphtheria, acute poliomyelitis, scarlet fever, measles, mumps, typhoid fever, jaundice, or having experienced an explosive epidemic of any communicable disease, the port surgeon informed certain prescribed health authorities of the theater by the most expeditious method available. These included the Chief Surgeon, the Surgeons of base sections to which troops were assigned and the commanding officers of all posts and stations to which troops were traveling.

Finally the port surgeon was required to issue to arriving units that portion of their unit medical equipment prescribed by theater regulation, to accept and give receipts for medical supplies carried by ships with no transport surgeon, and to expedite to the nearest United States Army Medical Depot the requisitions of transport surgeons for such medical supplies as were needed for the next anticipated voyage.

The procedures for the reception of transports of foreign registry bearing United States troops, were precisely the same as those prescribed for ships of United States registry, except that responsibility for clearance of the ship and the ship's crew was not assumed by the port surgeon or his representative unless specifically so requested by the civilian port surgeon under written designation as his representative.

The procedures outlined for transports were employed for hospital ships carrying United States troops with such modifications as were made necessary by the status of the military personnel.

The procedures for the reception of cargo ships of United States registry provided that the Operations Division of the port notify the port surgeon in writing of the expected date and time of arrival of all cargo vessels of United States registry. As soon as such information was available, the port surgeon boarded each incoming vessel in such good time as to prevent delay of the movement of the vessel by the procedures which he was required to complete.

Upon boarding the vessel, the port surgeon reported to the ship's master or his designated representative. The port surgeon then furnished information regarding the local United States Army facilities for hospitalization and for medical care of the ambulatory sick and at the request of the master, arranged for hospitalization in the most convenient United States hospital of members of the crew for whom hospital care was deemed necessary, provided that the ship had been previously cleared by the local civilian port medical officer.

The port surgeon inspected all United States military personnel aboard for communicable disease and for vermin and they were not allowed to disembark until this inspection had been completed. He arranged for hospitalization in the most convenient United States military hospital, of United States military personnel who were ill or who were suspected of having a communicable disease in an incubationary stage. No inspection of the ship's crew nor of the ship itself was made by the port surgeon. Clearance of the ship and crew was brought about by the local civilian port medical officer.

Sanitary Control of Ports of Continental Europe.--When operations were initiated on the continent, the regulations already applying in Great Britain became operative in respect to ports in France; except that in the early phases of operation, all ports used by United States forces were necessarily under their direction and complete control.

In late 1944 a number of regulations were issued by the War Department concerning the control of international traffic by sea and by air. These included a new Army regulation on foreign quarantine, and two circulars elaborating quarantine procedures.

The United States Army Quarantine Liaison Officer visited the theater in February of 1945, reviewed the existing port and airport regulations of the theater and made minor recommendations

designed to bring the practices of the European Theater in the control of sea traffic into agreement with those in force in theaters of operation of the United States Army generally. The value of uniform procedures was apparent.

A revised circular on the sanitary control of ports incorporated these recommendations, clarified certain administrative procedures involving reports, and brought the previous regulations into agreement with altered conditions and new situations encountered in the course of operations on the continent.

The responsibility for granting pratique to ships bearing United States personnel or cargo on entry into continental ports used exclusively by the United States armed forces rested solely with the United States military port authorities operating the port. In continental ports used for both United States military and European civilian purposes, specific areas of the port were designated as the responsibility of the United States Army and others that of the civilian port authority. This arrangement placed the sanitary control of continental ports on a basis of those being used by the United States Army being completely under their control, and those used wholly by the French or other nationals in military or civilian operations under their individual control. Separate areas under individual control of the nations using the facility were provided where two countries made use of the same port.

The clearance of all cargo ships of United States registry entering continental ports was made an obligation of the Port Surgeon of the United States Army. (Figure 1). The previous condition of clearance by the civilian port medical officer was maintained in the United Kingdom.

The transport commander of each departing troop transport furnished a statement certifying that all military and civilian personnel who were embarked had satisfied theater immunization requirements, were free from quarantinable disease and were free from vermin. Exceptions were permitted only in the case of immunization requirements and these were specifically noted in order that deficiencies might be corrected enroute.

The latter change was significant in that for the first time it provided for clearance on departure, a necessary measure in connection with redeployment of troops. (Figure 2) Other than minor changes in respect to records and reports, the remaining provisions of the new order were the same as in the previously published directive.

✓ Sanitary Control of Airports.--A well-developed organization for the control of traffic by sea had developed over the course of many years in most countries of the world. Even those with health organizations which by modern standards failed to reach a very high order of accomplishment, had systems of port control and quarantine which served more or less adequately to limit the spread of the quarantinable diseases. In Great Britain, and in the continental countries within the scope of military operations of the European theater, sanitary port control had been at a high level for many years.

The United States Army in the course of its military planning had established Port Battalions and port organizations. Systems of procedure had been defined to deal with the health problems of sea ports. The system in respect to air traffic and the sanitary control of airports was less firmly established and had attained a less secure level of organization. International air traffic was relatively new. It had just been getting under way on a commercial basis before the war. The onset of military operations brought a tremendous increase in volume and a complexity magnified many fold.

Sea traffic entered Great Britain at a few well-defined ports, with systems of port control that had existed for many years. Enlargement and refinement of control measures were often required, but there was a good foundation upon which to build. Separation existed between combat and ordinary military traffic, in that certain ports were set aside primarily for the use of the Navy and others were designated for the reception of transports and the usual military movements by sea.

Airports were commonly war time developments, newly constructed and newly organized, with relatively little tradition or experience in the health measures required to assure safe movement of international traffic. The same airport commonly served both combat planes and those engaged in the ordinary traffic of war, the movement of troops and of urgently needed supplies. Air traffic into the theater was furthermore predominantly related to combat activity, in contrast to sea operations which had to do in the European Theater primarily with the movement of troops and supplies.

The number of airports was infinite in comparison with sea ports. They were scattered all over the theater in contrast to seaports which were located along the fringes of the operational area. The volume of intra-theater air traffic was much greater than that of sea traffic. Planes arrived after having called in all manner of airports, which gave rise to the possibility of transmission of communicable diseases from Africa, the Near East,



Figure 1

The dock area of the Port of Marseilles, France. Ships in the outer harbor await clearance. October 1944.



Figure 2

The first soldiers to be discharged under the point system and liberated prisoners of war mount the gang plank of a ship back to the United States, May 1945.

South America, and even from the Far East. The great bulk of sea traffic was representative of an uninterrupted passage from relatively safe points of departure in the Zone of the Interior. The extent of the problem of adequate sanitary control was much greater for airports than for seaports, and decidedly more complicated.

Shortly after action had been taken in 1943 to formalize the health measures related to maritime traffic, inquiries were made on the nature of existing procedures concerning air traffic. Several kinds of travel by air were involved.

International Traffic by Combat Planes.--Combat planes are first considered. A great volume of movement was involved in missions over Europe, originating from the United Kingdom but with departure and return both related to the home air port where bombers were stationed. The opening of the continental campaign increased these activities, and in addition the Ninth Air Force became operational on the continent. Spotter and other planes attached to armies still further increased air traffic. (Figure 3) The shuttle operations to Russia, to Italy and to Africa introduced the problems of international traffic and far more pertinent health problems. Intra-theater traffic was always measureably great. It increased tremendously when operations extended into Germany.

Long distance international traffic came into important consideration. Large numbers of combat planes were flown to Europe from the Zone of the Interior to be put into operations in the theater. Sometimes they flew non-stop from the Zone of the Interior by the relatively direct northern route. In many instances, and at particular times of the year, the longer southern route was used, with numerous stops in tropical and sub-tropical regions. (Figure 4)

International Traffic by Transport Planes.--Transport planes presented the major health consideration. The traffic was primarily between the theater and the Zone of the Interior. The conditions of travel were like those of combat planes in course of delivery, with varying degrees of risk dependent on the route traveled; whether it was the relatively direct northern route or the longer, more potentially hazardous southern route. Inter-theater traffic between Europe, Africa and Italy was no inconsiderable feature. Truly international traffic involved scheduled runs between the theater and Iceland, later to the Scandinavian countries, to Russia and even to the Far East, particularly in the latter days of operations.

Intra-theater movements were numerous, especially after the onset of operations in Europe because of the relatively great distances involved and the necessity for maintaining contact between France, Germany and Britain.

Development of a Program for Sanitary Control.--The problem of sanitary control of airports was approached in much the same manner as in respect to seaports. Numerous airports were used jointly by the British and American forces particularly in the early days of the theater, but in no instance was British control exercised over health considerations at such airports. Whether the airport was primarily operational, in the sense of being concerned only with combat activities, or whether it had to do with transports and similar military movement, British and American authorities were individually responsible for sanitary control measures. Airports which were wholly American were under American control for sanitation and quarantine.

It was deemed desirable that the principles of sanitary control should rest on common grounds and that so far as feasible uniform and coordinated practices should govern British and American movements by air. The British sanitary laws covering traffic to and from the United Kingdom were being circumvented by American forces, commonly without intent, through lack of proper British or American control at airports in the United Kingdom and at airports of departure for the United Kingdom in other regions. Infractions of regulations were sufficiently frequent to constitute a serious health threat.

The British had stringent and efficient laws governing sanitary control of traffic to and from the United Kingdom. For the application of these laws they had adequate administrative procedures at seaports. A committee composed of the British Ministry of Health, and representatives of the three British military forces had been working on the problem for approximately two years, looking toward devising as simple a procedure and staff as was feasible for the application of existing laws to air traffic.

Their investigations indicated that currently it was impossible to set up the necessary staff or administrative procedures to apply the sanitary laws to airports in the same manner in which they were applied to seaports. In looking toward this development certain administrative procedures had been developed by the committee which were in substantial agreement with the proposals made by the Chief Surgeon of the European Theater for the control of air movement. British authorities gave specific endorsement to the proposed plan.



Figure 3

A plane of the 1st Infantry Division lands on a newly acquired section of the Autobahn superhighway in Germany, March 1945.



Figure 4

A Flying Fortress arrives from the Zone of the Interior at an American Airdrome in England.



Figure 4

A Flying Fortress arrives from the zone of the
Inferior at an American Airbase in England.

The Air Transport Command was more intimately concerned with these problems than any other unit of the air forces in Europe. A field survey of the principal airports maintained by that organization was accomplished as a joint activity of the Division of Preventive Medicine of the Office of the Chief Surgeon and of the Surgeon of the Air Transport Command. Practices in sanitary control and in quarantine at the several air forces were based on existing regulations of the service. While a certain uniformity of pattern existed, in no two airports were practices alike and individual differences were sometimes great.

With all other information at hand a thorough review and discussion was held with the Surgeons of the Eighth and Ninth Air Forces. Air traffic under control of these two organizations included the majority of activities within the Theater. They were principally concerned. Together a draft of regulations was prepared and submitted for publication as a command directive of the theater.

Regulations for the Sanitary Control of Airports.--The purposes of these newly defined regulations were to prevent the transportation and spread of communicable or quarantinable diseases, through examination of crew members and passengers upon arrival in the United Kingdom for evidence of these diseases and for vermin; to effect disinsection in accordance with air force directives; and to prohibit animals from being carried or imported into the theater from other countries by air craft. (Figure 5)

The communicable diseases were defined in precisely the same manner as for seaports and likewise the quarantinable diseases. An endemic area south of 54° north latitude and north of 45° south latitude, excluding territories included within the United States, Canada, and the British Isles.

Procedures for the reception of incoming aircraft provided that the Operations Division of each air base in the United Kingdom notify the Base Surgeon of the estimated time of arrival of aircraft from airports outside the United Kingdom, in order that the surgeon or his representative might be on the field to meet such incoming aircraft.

All passengers and crew members proceeded to the medical clearance room where each crew member and passenger was examined for communicable disease and vermin, unless such examination had been made within 48 hours of arrival. The surgeon of the airdrome quarantined all passengers and crew members of aircraft carrying a diagnosed or reasonably suspected case of typhus, yellow fever, smallpox, plague, or cholera; and the aircraft was disinfected.

In the event of the arrival of personnel having cerebro-spinal fever, diphtheria, acute poliomyelitis, scarlet fever, measles, mumps, typhoid fever or jaundice, the patient was hospitalized in the most convenient United States military hospital and the Surgeon of the airdrome by the most expeditious method available notified the Chief Surgeon of the theater, the Surgeon of the air command concerned and the commanding officers of all commands to which the military personnel aboard were assigned.

Each passenger and crew member who arrived from areas of endemic insect-borne disease, from areas where a quarantinable disease was known or suspected to exist, or on aircraft bearing a communicable disease were given a prescribed form card. The card informed the passenger that while on board the aircraft he might have been in contact, without knowing it, with some dangerous epidemic disease prevalent in other countries. He was therefore advised that if he felt ill during subsequent days that he should consult his medical officer or doctor immediately and give him the card, which bore notice to the physician of essentially the same import and requested that in the event of significant clinical observations that notice should promptly be given to the Chief Surgeon of the European Theater. The immunization register of each military passenger or crew member was inspected.

The commanding officer of each air base in the United Kingdom caused the following measures to be accomplished for aircraft arriving from endemic areas of insect-borne disease. The pilot furnished a certificate according to a prescribed form, showing compliance with the provisions of air force regulations before members of the crew or passengers were permitted to disembark. Certificates of disinsectization for all such aircraft were forwarded weekly to the Surgeons of the air commands concerned. The base Surgeon made frequent inspections of aircraft to determine that disinsectization was properly performed.

Aircraft arriving from an area in which typhus was prevalent, and on which passengers or crew members showed evidence of louse infestation or gave history of exposure to the disease were disinfested in accordance with existing regulations of the Chief of Transportation, War Department.

Animals, including mammals, birds, fish, reptiles and insects, were not carried or imported from other countries by airplanes except that animals transmitted with official certificates stating that they were for military or medical use and that all sanitary and medical precautions had been taken to prevent the spread of the disease, might be so carried. Aircraft were inspected upon arrival and animals imported without an official certificate



Figure 5.

British and United States paratroopers with their Icelandic mascot en route to England in a C-47, August 1943.

were confiscated. The nearest representative of the Ministry of Agriculture and Fisheries was notified and he collected the animal and assumed responsibility for its proper disposition.

Procedures for aircraft outbound to overseas airdromes included inspection of immunization registers of military personnel. No person was allowed to proceed who had failed to comply with the immunization requirements in respect to yellow fever. All outbound passengers and crew members were briefed on the health hazards to be encountered enroute, and the most effective preventive measures were outlined. (Figure 6)

Foreign aircraft arriving or departing from airports under the jurisdiction of the United States Army were required to conform with the regulations established for aircraft of the United States. A slight change in the procedures relating to disposition of animals illegally brought into the theater became necessary because no law existed in England in respect to certain animals. Their disposition was left to the descretion of British officials by a second revised directive.

The several circulars issued by the War Department late in 1944, reference to which has already been made in connection with the discussion on seaports, introduced significant changes into the procedure for control of air traffic. The most important alteration was in respect to the time of inspection, which substituted predeparture certification for the classical method of inspection on arrival. This procedure had been selected for its advantage in military traffic and theoretically it contributed to a more complete attainment of purpose. The United States Army Quarantine Liaison Officer suggested that appropriate changes be made in the regulations of the theater to bring them in accord with general practice of the United States Army throughout the world generally.

Quarantine clearance on the basis of predeparture certification was proposed to the British Ministry of Health with particular reference to military aerial traffic, and as alternative to the traditional processing upon arrival. Their approval and indorsement was obtained. The United States Public Health Service had furthermore agreed to suspend quarantine requirements in the case of personnel aboard military aircraft who departed the United Kingdom for the United States after at least two weeks residence in the United Kingdom, in the absence of quarantinable disease in significant degree. A substitute theater directive was therefore prepared, designed to bring about implementation of War Department and theater procedures.

The methods of disinsecting aircraft were altered to conform to newly published procedures of the Army Air Force. It was likewise possible to increase the number of areas exempt from disinsection which previously had included the United States, Canada and the United Kingdom and certain areas on the European continent. New regulations exempted planes from spraying if traveling from Iceland, Greenland, Newfoundland, Labrador, Bermuda, and the Bahamas. It has also become apparent that planes from the Azores Islands need not be treated because of the very limited presence there of potential disease bearing insects and the energetic mosquito control about air ports of departure.

The most important change in regulations was that all crew members and passengers were determined to be free from communicable disease and vermin before departure from the theater and also on arrival from localities outside the theater, unless certified to have had such examination within 48 hours of arrival.

In implementation of these newly defined regulations and to coordinate them with Army regulations and War Department circulars, a memorandum was prepared by the European Division of the Air Transport Command which set forth in detail the provisions required for the quarantine of aircraft and the management of airborne personnel. The substance of this memorandum is given below:

Quarantine of Aircraft and Air-Borne Personnel.--A medical Clearance Room will be set up in or near passenger terminals of EURD ATC base units, where the appropriate medical procedures outlined will be accomplished.

Definitions

Quarantinable Diseases are those recognized as such by the International Sanitary Convention, i.e. typhus, yellow fever, smallpox, plague and cholera.

Endemic areas of insect-borne diseases are those areas south of 54 degrees north latitude, and north of 45 degrees south latitude, except the United States, Alaska, Canada (and adjacent areas), British Isles, Newfoundland, Mexico, Curacao, Aruba, Bahamas, Bermuda, Azores, Galapagos Isles and that part of Continental Europe west of 13 degrees east longitude and north of 42 degrees north latitude.



Figure 6

Soldiers of the 1st and 9th Infantry Divisions homeward bound by Air Transport Command, Orly Field, Paris, June 1945.

Communicable Diseases:

Cerebrospinal Fever (meningococcic)	Pneumonia, primary	Smallpox
Common Respiratory diseases	Pneumonia, secondary	Fever, still undiagnosed
Diphtheria	Poliomyelitis, acute	Tetanus
Influenza	Scarlet Fever	Pneumonia, pri- mary atypical
Measles	Tuberculosis, all forms	Hepatitis, epi- demic
Measles, German	Typhus Fever	Vincent angina
Mumps	Yellow Fever	Whooping Cough
Typhoid Fever	Chancroid	Cholera, asiatic
Paratyphoid Fevers	Gonorrhea	Common Diarrheas
Types A and B	Syphillis	Dysentery, bacil- lary
Dengue	Lymphogranuloma	Dysentery, Proto- zoal
Malaria	Inguinale	Dysentery, un- classified
Plague, Bubonic	Granuloma Inguinal	
Relapsing Fever	Chickenpox	
Plague, pneumonic	Scabies	

Responsibility

Commanding officers of all AAF Base Units are responsible, with the technical advice of the Post Surgeon and within the jurisdiction of the Army, for the enforcement of regulations and directives pertaining to quarantine. A specific responsibility of the commanding officer is the designation of personnel for inspection of all aircraft, with the exception of aircraft excepted below, to determine whether animals, plants, or the products thereof are being imported without an official permit.

1. Operations Section is responsible for disinsectization of aircraft and maintenance of appropriate records thereof.

2. Priorities and Traffic Section is responsible for:

Inspection of all incoming EURD ATC scheduled transport aircraft to determine whether animals, plants, or the products thereof are being imported without an official permit.

Certification on passenger manifest of outgoing aircraft that all persons aboard meet quarantine requirements. Review of all passenger manifests on incoming aircraft and notification to the Post Surgeon of any exceptions to quarantine requirements.

3. The Medical Department is responsible for:

Technical supervision of quarantine functions, including inspections, recommendations, and consultation.

Certification at airports of departure that individuals meet quarantine requirements.

Accomplishment of appropriate measures at airports of arrival in regard to all quarantine risks.

Submission of reports on quarantine.

Maximum use should be made of personnel other than that of the Medical Department in the execution of the foreign quarantine program since the bulk of the procedures are routine and clerical and can be carried out by personnel otherwise concerned with processing of conveyances and traveling personnel.

Procedures for Aircraft to Overseas Airdromes.

Medical Briefing: Commanding Officers of Aerial Ports of Embarkation and of all stations along foreign routes will be responsible for medical briefing of all personnel.

Quarantine of Personnel:

Travel in aircraft under the jurisdiction of EURD ATC will be contingent on the satisfaction of immunization requirements of the War or Navy Department, and on freedom from vermin or quarantinable diseases. Prior to departure from one theater of operations to another on EURD ATC aircraft, all personnel will have in their possession a certificate, EURD Form 536 (MD) (Inclosure 3) signed by a Medical Officer within the previous 48 hours, certifying that the individual satisfies these requirements. Duplicate copies of this form will be accomplished, the second copy of which will be turned in to Priorities and Traffic by the individual at the time the ticket for air travel is issued.

The pilot of the aircraft will be notified in writing that all persons aboard, unless otherwise indicated on EURD Form 537 (MD) (Inclosure 4) have met these requirements. This certificate will be in addition

to the individual certificate referred to above. If there are no exceptions to the quarantine requirements, EURD Form 537 (MD) (Inclosure 4) need not be accomplished and this certificate may be fulfilled by entering the following statement on the manifest:

"All personnel listed on this manifest are free from quarantinable diseases and vermin. Current immunization requirements of the War Department have been met or are in the process of being met."

This certificate will be signed "For the Commanding Officer" by a responsible officer.

Military and civilian personnel of foreign countries traveling on U.S. military aircraft will not be required to comply with existing U.S. military regulations on immunization with the exception of smallpox (in all those cases not covered below) and yellow fever when required by regulations of countries to and through which travel will occur. Such individuals should be advised of the value of immunization and may be immunized upon their request. For immunization requirements of all other personnel see Immunization Chart attached as Inclosure 1.

Aircraft and ~~passengers~~ departing from an area in which typhus is prevalent, and on which passengers or crew members show evidence of louse infestation or give history of exposure to typhus, will be disinfested prior to departure.

No person will be transported by air who is ill with pneumonic plague or whose last possible contact with pneumonic plague has been within seven (7) days.

Waivers of any of the above requirements will be made and embarkation permitted only under circumstances of great urgency and when recommended by the Medical Corps Officer conducting physical inspection and immunization and approved by the Commanding Officer of the port of aerial embarkation. Yellow fever immunization will not be waived unless requirements for it have also been waived officially by countries to and through which travel will occur.

Disinsectization of Aircraft:

In view of the danger of introduction of insects which are economic hazards or vectors of disease, aircraft under Army jurisdiction departing any station in areas of endemic insect-borne disease (see above) regardless of destination will be disinsectized as follows:

Disinsectization will be carried out immediately prior to departure of the aircraft concerned, using aerosol insecticide or a substitute therefor as described in Inclosure 2, attached. Disinsectization will be accomplished:

By the pilot of the aircraft or, under his direction, by personnel of the flight crew;

After full loading of fuel, baggage, cargo, passengers and crew, and during or prior to the warm up of the engines; With all doors, windows, hatches and other openings closed during spraying, and until take-off, which shall not be sooner than two (2) minutes after spraying with hand sprayer; In all cabin, cockpit and baggage compartments and other places deemed necessary; if any are inaccessible from within the airplane, they will be sprayed when loading is completed; and

Will be certified in the clearance (AAF Form No.23 or the equivalent) of the aircraft, as well as signalled to the control tower. Aircraft will not be cleared for take-off until completion of disinsectization has been indicated to the control tower. Operations officers will maintain appropriate records by filling AAF Form 23, with notation thereon of action taken at both ports of departure and port of entry.

Quarantine of Plants, Animals, and their Products:

In order to avoid the transmission of animal or plant diseases and pests, and in order to observe strictly all pertinent civil and military regulations, no animal or plant product likely to convey disease or subject to quarantine or other restrictive regulations, and no living plant or animal (mammal, reptile, bird, fish, etc.) will be carried across national boundaries by airplane under the

jurisdiction of the Army except upon specific permit. This permit will be secured in advance from the proper civil authority of the country into which importation is intended with the approval for the appropriate Theater Commander. Pertinent regulations of the United States, its territories and possessions are noted in Appendix II of AAF Regulation 61-3, dated 9 August 1944.

Such permits will be requested only for plants, animals and plant or animal products intended for scientific, educational or military purposes. Requests will show the species and numbers, type of container, source, destination, purpose for which intended, and the nature of any pathologic state.

It will be the responsibility of the shipper properly to pack, crate, tie, administer sedative drugs to when necessary, and arrange for care of, all animals during flight. Written instructions for care, including feeding, watering, exercise, etc., will be attached. Conspicuous labels, containing instructions for full protection of handlers, will be attached to all cages containing animals infected with pathogenic organisms, or the animals will be accompanied by a person responsible for their care; proper disposition will be specified for bedding, dejecta, and other material liable to be contaminated.

Even though otherwise authorized, no animal will be transported by aircraft unless certified by a qualified veterinarian to be free from disease, except as provided above.

Pathogenic cultures or tissues, or animals infected with pathogenic organisms, may be carried by aircraft only under the provisions above.

Pathogenic cultures or tissues intended for shipment by mail will be packed in accordance with postal regulations. (U.S. Code, Title 4, Section 589, Postal Laws and Regulations. See also AR 40-310, Collection and Shipment of Specimens to Laboratories).

✓
Raw meat and dressed poultry, or kitchen waste containing scraps thereof, will not be landed by aircraft except in accordance with pertinent military and civil regulations. Particular attention is directed to restrictions pertaining to the use or sale of such material for animal feeding.

Procedure for the Reception of Incoming Aircraft.

Upon arrival, all aircraft will be inspected to determine whether any animals or plants or the products thereof are being imported without an official certificate. If such is the case, animals imported without an official certificate will be confiscated or destroyed, except that in the United Kingdom the nearest representative of the Ministry of Agriculture and Fisheries will be notified, who will collect the animal and assume responsibility for its proper disposition.

For aircraft arriving from airports within the same Theater of Operations and not from endemic areas of insect-borne disease, no quarantine procedures are necessary.

On aircraft arriving from another Theater of Operations and not from endemic areas of insect-borne disease, the following will be accomplished.

The pilot of incoming aircraft will furnish the appropriate officer at the port of arrival with the statement which is written on the passenger manifest certifying that all persons aboard the aircraft are free of vermin and quarantinable disease and that they satisfy current WD Immunization requirements. If there are any exceptions to this statement, they will be listed on EURD Form 537 (MD) (Inclosure 4) in the space provided and this form will be furnished the appropriate officer in lieu of the statement on the passenger manifest. These certificates will be filed with the manifests for a period of six months at the airport of arrival.

If there are no exceptions to WD immunization and quarantine requirements as shown by the certifying statement on the manifest, no quarantine procedures will be necessary at airport of arrival.

If there are exceptions to WD immunization and quarantine requirements for air travel as shown on EURD Form 537 (MD) (Inclosure 4), or if there is no certification of quarantine requirements, such individuals will proceed to the Medical Clearance room where the surgeon or his representative will accomplish the following:

Incomplete immunizations will be completed as far as possible in accordance with Immunization Chart (Inclosure 1) and passengers will be examined for quarantinable disease and vermin. If quarantinable disease or vermin is found among U.S. military or U.S. Civilian personnel, movement of such cases will be restricted and disposition of persons concerned will be made by the post surgeon. If quarantinable disease or vermin is found in foreign military or civilian personnel, movement of such cases will be restricted and the appropriate military or civilian quarantine authority will be informed. Disposition of personnel concerned will be as requested by the appropriate quarantine authority.

If an aircraft arrives from areas where a quarantinable disease is known or suspected to exist, or an aircraft arrives carrying an individual who is suspected of having a quarantinable or communicable disease, all passengers and crew members will be given a card, EURD Form 538 (MD) (Inclosure 5).

In the event of the arrival of personnel having cerebrospinal fever, diphtheria, acute poliomyelitis, scarlet fever, measles, mumps, typhoid fever, or hepatitis, the patient will be hospitalized in the most convenient U.S. Military Hospital and the surgeon of the airdrome will, by the most expeditious method available, notify the Chief Surgeon of the Theater concerned, the Surgeon of the EURD ATC, and commanding officers of all commands to which the military personnel aboard are assigned.

On aircraft arriving from endemic areas of insect-borne disease, the following will be accomplished:

Before any of the crew or passengers are permitted to disembark, the pilot will furnish the operations officer or his representative with the certificate of disinsectization of aircraft, showing compliance with the provisions of AAF Regulation 61-3 dated 9 August 1944. This statement may be certified on the Clearance (AAF Form No. 23, or its equivalent).

Each passenger and crew member arriving in the European Theater of Operations from areas of endemic insect-borne disease will be given a card, EURD Form 538 (MD) (Inclosure 5).

Scope

The provisions of this Memorandum will apply to all aircraft, including foreign aircraft, arriving or departing bases completely controlled by EURD ATC. At bases where EURD ATC shares joint occupancy and control with other units of the U.S. Army, or with foreign governments, the provision of this Memorandum will apply only to aircraft under EURD ATC jurisdiction.

Reports

In compliance with par 3 a (6), AR 40-225, dated 21 November 1944, reports of foreign quarantine activities performed by personnel of the Army will be included in the monthly sanitary report under paragraph "Subjects not covered by other headings."

Patients

Patients being evacuated by aircraft are exempt from the provisions of this Memorandum.

IMMUNIZATION REQUIREMENTS - EUROPEAN DIVISION ATC

For Travel to or Through or Stationed in the Following Areas (1)

AREA	EUROPEAN THEATER	MEDITERRANEAN THEATER AFRICA, EUROPE (other than ETO), MOUNTAINOUS CENTRAL & SO. AMERICA, MEXICO & ALASKA	ASIA (RUSSIA) MIDDLE EAST PERSIAN GULF EAST INDIES	CENTRAL AFRICA CENTRAL & SOUTH AMERICA (2)	PACIFIC OCEAN AREA WEST OF HAWAII	
	Original Stim	Original Stim	Original Stim	Original Stim	Original Stim	
All U.S. Military Personnel & U.S. Civilians on Fld. Duty Status	Smallpox Typhoid Tetanus Typhus	3 yr 1 yr 1st yr 1 yr	Smallpox Typhoid Tetanus Typhus Cholera	1 yr 1 yr 1st yr 6 mo 4 yr	Smallpox Typhoid Tetanus Typhus Cholera Plague	1 yr 1 yr 1st yr 6 mo 6 mo 6 mo
All AAF Personnel other than ATC Air Crew	Smallpox Typhoid Tetanus Typhus Cholera Yellow F	3 yr 1 yr 1st yr 6 mo ----- -----	Smallpox Typhoid Tetanus Typhus Cholera Yellow F	1 yr 1 yr 1st yr 6 mo ----- 4 yr	Smallpox Typhoid Tetanus Typhus Cholera Plague Yellow F	1 yr 1 yr 1st yr 6 mo 6 mo 6 mo -----
All AAF ATC Air Crew Personnel	Smallpox Typhoid Tetanus Typhus Cholera Yellow F	1 yr 1 yr 1st yr 6 mo 6 mo 4 yr	Smallpox Typhoid Tetanus Typhus Cholera Yellow F	1 yr 1 yr 1st yr 6 mo 6 mo 4 yr	Smallpox Typhoid Tetanus Typhus Cholera Plague Yellow F	1 yr 1 yr 1st yr 6 mo 6 mo 6 mo 4 yr
POW & US Civilians not on Fld. Duty Status	Smallpox Typhoid Typhus	3 yr 1 yr 1 yr	Smallpox Typhoid Typhus Cholera	1 yr 1 yr 6 mo 4 yr	Smallpox Typhoid Typhus Cholera Plague Yellow F	1 yr 1 yr 6 mo 6 mo 6 mo 4 yr
All Other Including Foreign Military & Civilian Personnel	Smallpox	3 yr	Smallpox	1 yr 4 yr	Smallpox Typhoid Typhus Cholera Plague	1 yr 1 yr 6 mo 6 mo 6 mo

- (1) Prior to departure of individuals from overseas commands immunization requirements of the Command concerned and of any land areas to be traversed while enroute to the U.S. will be complied with.
- (2) YELLOW FEVER. All personnel traveling to or through (or stationed in) endemic yellow fever areas by Army transport or airplane, will be immunized against yellow fever within four years and not less than 10 days prior to entry into an endemic yellow fever area. This policy applies to all persons ten years of age and older. In order to meet the requirements of certain foreign governments, children under ten years of age who travel by Army transport or airplane must have been immunized within two years.

For the purpose of meeting quarantine requirements of all foreign countries, the endemic yellow fever area is defined as follows;

- (1) In the Eastern Hemisphere, that portion of Africa lying between latitude 18° South and the Northern borders of French West Africa, French Equatorial Africa, and the Anglo-Egyptian Sudan, including the islands immediately adjacent thereto.
- (2) In the Western Hemisphere, the mainland of South America lying between latitudes 13° North and 30° South, including the islands immediately adjacent, and Panama, including the Canal Zone. However, transit through the Panama Canal with brief sojourns within the Canal Zone will not be considered as travel through an endemic area.

A. Use of Aerosol Insecticide (QM Issue, Stock No. 51-1-159):

1. Follow instructions on container, or furnished with item.
2. Spray all compartments and spaces, dividing proportionately the overall time indicated in the table below.

B. Alternate Insecticide:

In lieu of Aerosol Insecticide, disinsectization may be accomplished by fine vaporization from a hand or other spray of a 1 to 5 dilution in kerosene, etc., of standardized pyrethrum extract (marketed as pyrethrum concentrate, 20 to 1 strength;

pyrethrum extract standardized; pyrethrum extract No. 20; pyrethrum concentrate No. 20; or No. 20 extract standardized). Approved insecticide and hand spray may be obtained from Quartermaster, and should be used in accordance with the table below.

TYPE OF AIRCRAFT	AEROSOL (hold 2 min)	HANDSPRAY (hold 5 min)
Single-seat Planes	3 sec	3 cc
B-17, B-25, B-26, C-47, etc.	15 sec	10 cc
B-24, C-87, etc.	25 sec	15 cc
B-29, C-54, etc.	40 sec	25 cc

A watch with second hand will be used by all sprayers.

PRE-EMBARKATION HEALTH CERTIFICATE

Name _____ Rank _____ Serial No. _____

For the information of quarantine officers and for transmittal to the responsible commanders enroute and at destination, the following statements are herewith certified:

1. Those infectious and parasitic diseases to which the personnel concerned have been exposed, or which are known to be present among them, are as follows:

2. The exposure to or incidence of vermin among the personnel (or the incidence of vermin infestation in the areas from which the personnel are drawn) is as follows: _____

Disinfestation (was) (was not) performed _____

_____ (date)
3. This (officer) (enlisted man) was inspected at _____
(date) (hour) and was found free of acute communicable disease including venereal disease, with the following exceptions: _____

4. He is not suffering from a quarantinable disease (cholera, leprosy, smallpox, plague, epidemic typhus or yellow fever) with the following exceptions: _____

5. He satisfies immunization requirements of AR 40-210 and other War Department and pertinent theater directives concerning special immunizations. Special cognizance is taken in this regard of the requirements of land areas to and through which he will be transported. The following exceptions are made: _____

For the reason of _____

6. This individual will be required to take prophylactic atabrine until _____ (date)

(Name of examiner) (Grade) MC

This certificate expires 48 hours after the date shown in paragraph 3 if plane is not boarded.

EURD Form 537 (MD).

STATEMENT OF COMPLIANCE WITH WAR DEPARTMENT
REQUIREMENTS FOR AIR TRAVEL

All persons aboard aircraft _____
(Number, flight, etc.)

are certified to be free of vermin and quarantinable disease*, and to
satisfy immunization requirements of the War or Navy Departments for
duty abroad, except as noted below:

No. exception ().

NAME	CHARACTER OF EXCEPTION	REASONS THEREFORE	EVIDENCE OF NECESSARY AND WAIVER REQUIREMENTS
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Date _____

Place _____

For the Commanding Officer:

Name of Officer Rank Position

*Cholera, leprosy, plague, smallpox, louse-borne typhus, yellow fever

EURD Form 538 (MD)

Important Notice to all persons Arriving by Air from Other Countries

While abroad, you may have been in contact, without knowing it, with some dangerous epidemic disease prevalent in other countries. Therefore, if you fall ill during the next 21 days, consult your medical officer or doctor immediately and give him this card so that he may see the notice on the reverse side.

Notice to Medical Officer
or Physician

The bearer _____ arrived in this country
by air at _____ on _____ in aircraft No. _____

It is consequently possible that the holder of this card may be suffering from some form of infectious or tropical disease acquired elsewhere, and has arrived before the end of the period of incubation. If you find or suspect such a condition, notify the Chief Surgeon, European Theater of Operations U.S. Army, APO 887, U.S. Army, at once.

FIGURES

1. The dock area of the Port of Marseilles, France. Ships in the outer harbor await clearance, October 1944.
2. The first soldiers to be discharged under the point system and liberated prisoners of war mount the gang plank of a ship back to the United States, May 1945.
3. A plane of the 1st Infantry Division lands on a newly acquired sector of the Autobahn superhighway in Germany, March 1945.
4. A Flying Fortress arrives from the Zone of the Interior at an American airdrome in England.
5. British and United States paratroopers with their Icelandic mascot enroute to England in a C-47, August 1943.
6. Soldiers of the 1st and 9th Infantry Divisions homeward bound by Air Transport Command, Orly Field, Paris, June 1945.

A HISTORY OF PREVENTIVE MEDICINE

IN THE

EUROPEAN THEATER OF OPERATIONS

UNITED STATES ARMY

1941 - 1945

Part IV - Nutrition

by

(Colonel Wendell H. Griffith, SNC.

Chief of Nutrition Branch, Division of Preventive Medicine

Office of the Chief Surgeon, ETO

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Part IV - Nutrition

A Nutrition Branch was established in the Division of Preventive Medicine of the Office of the Chief Surgeon, ETOUSA, following the arrival late in August 1942 of the Nutrition Officer who was to serve as Chief of the Branch for the ensuing three years. At this time, two additional nutrition officers, assigned to the Eighth Air Force, reported for duty in the theater. Although the first large convoy of troops had disembarked in North Ireland in the latter part of January 1942, the total American force in the British Isles amounted to only 156,000 men by the first of September, nearly one-half of these having arrived during the month of August. The Nutrition Branch began its activities, therefore, early in the history of the theater and at a period when the ration scale for troops in ETOUSA was still a subject of discussion. From that time it set the dietary standards for rations provided by the Quartermaster and it determined the nutritional needs of the Army. The Nutrition Branch grew with the theater, as did also the magnitude of its responsibility for the nutritional health of troops and of hospital patients and the variety of its interests in all phases of army messing. By D-day, 6 June 1944, the number of nutrition officers had increased to 23 and that of troops to 1,549,000. Another one and one-half millions were added to the troop strength by May 1945. The enlargement of fixed T/O bed capacity and the increase in the number of hospital patients was even more spectacular. The total number of hospital admissions during 1942 was less than that during a 2-week period in the winter of 1944-1945. For the 4-week period ending 29 January, bed capacity, total admissions and patients remaining at the end of the period increased from 5727, 3789 and 3162 respectively, in 1943, to 203,670, 124,248 and 183,965 respectively in 1945. This extension of hospitalization in the theater as troop strength grew and as more and more units engaged in combat was of particular importance to the Nutrition Branch because the character and adequacy of the patient's ration were two of its primary concerns.

Relationship to the Quartermaster.--It was recognized that the functions of nutrition officers were investigative and advisory and that the accomplishment of the mission of the Nutrition Branch depended upon complete coordination with commanding officers, responsible for mess operation, and with officers of the Quartermaster Corps, responsible for the procurement and issue of rations and for the training of mess personnel. The Chief Quartermaster welcomed the authority and relied upon the cooperation of the Medical Department with respect to the nutritional and sanitary aspects of messing. The joint interests and duties of the Nutrition Branch, Office of the Chief Surgeon and of the Subsistence Division,

Office of the Chief Quartermaster were notably strengthened by the teamwork and spirit of friendly helpfulness which characterized the officers of the two Services. This teamwork was so effective that it was possible for nutrition officers to serve as nutrition consultants to Quartermaster officers without prejudicing their function as representatives of the Medical Department, responsible for investigations and recommendations concerning the adequacy of the soldier's food.

Summary of Activities.--The sections which follow describe the planned program and accomplishments of the Nutrition Branch. Many and varied were these activities, including some which were wholly unexpected and for which no prior plans had been made. They centered on the preventive aspects of sound nutrition but included the nutritional rehabilitation of malnourished recovered American prisoners liberated from German stalags, a problem which turned out to be one of the most important purely medical problems confronted by the Chief Surgeon's Office. Field tests of the suitability of standard operational rations for combat troops in Europe were planned and directed, an activity of especial importance in the case of the new "10-in-1" ration which had not previously been subjected to trial under field conditions. As a result of these trials and of other accumulated experience pertinent recommendations were made concerning the composition of "C", "K" and "10-in-1" rations and particularly concerning desirable changes in the Overseas Expeditionary Force type "B" ration. The unofficial move to supply a so-called Americanized version of the British Army ration to American Forces in the United Kingdom was opposed and new ration scales for troops and hospital patients were pioneered. A troop ration was described in terms of groups of foodstuffs, in accordance with their nutritive significance, for the first time in a theater of operations of the U. S. Army; and, for the first time, hospitals were issued a type "A" patients' ration which did not require an added monetary allowance. The nutritional welfare of troops in combat was constantly emphasized in theater directives and by personal contact with officers of combat units. This was doubly necessary because of the tendency to exaggerate the value of convenience of transport and issue of operational rations with resulting potential damage to the nutritional fitness of soldiers. This program, which was actively supported by the Chief Quartermaster, was so successful that the great majority of combat units received the modified type "A" ration rather than "C" or "K" rations, even when in contact with the enemy (Figure 1). Nutrition officers were particularly prominent in the supervision of special procedures which were designed to maintain mess operation on a high level in the marshalling areas from which troops embarked for the liberation of France. Participation in programs to prevent waste of food and to develop a sense of individual responsibility for proper eating was encouraged.



Figure 1

Tankmen of the 94th Infantry Division eat hot food, brought by truck, while awaiting assignment to battle near Nennig, Germany, January 1945.

The manner in which nutrition officers met the challenge of these and other problems constitute irrefutable proof of the importance to the Army of competent representation of the Nutrition Branch in the organization of the Medical Department. This was not the case in the peace-time Army so that nutrition officers in ETO were often handicapped by lack of support from other officers, including medical officers, who neither understood the function nor realized the benefits of the nutrition program. The tendency has been widespread to view the mess as an activity of the Army which automatically looked after itself or which required only periodic inspection to ensure the periodic polishing of pots and pans. This attitude was strenuously opposed by nutrition officers to whom the proper procurement, issue, preparation and service of foodstuffs were indispensable factors for health - factors which merited the attention of a specialized, interested officer group.

Scope of Responsibilities of the Nutrition Branch.

Aim of Program.---The aim of the Nutrition Branch was the maintenance of the health and effectiveness of all U. S. Army military personnel in the theater insofar as health and effectiveness are influenced by the adequacy of the dietary and by the general acceptability of the ration, particularly by the manner in which the specific components are selected, combined, issued, cooked, served, and eaten. The Branch was aware of the beneficial effect of palatable, nutritious food on the fitness of troops and on the "esprit de corps" of units and fixed as a goal the attainment of superior messing in U. S. Army messes in the theater. Superior messing was defined as the service of tasty, clean, nutritionally-adequate food to men informed about food values, conscious of the necessity of conservation of food and possessed of a personal interest in nutritional health. Procurement and storage of suitable ration items, efficient distribution, and proper preparation were obviously additional prerequisites for the desired standard of messing. In supervising the adequacy of the soldier's dietary the activities of the Nutrition Branch were closely integrated with the general program of the Division of Preventive Medicine and were directed towards the preventive aspects of nutrition rather than towards the control of nutritional diseases.

Program.---The effects of light, moderate or heavy labor, of training, of combat, of hospitalization, and of convalescence in rest camps on food requirements were determined and the Quartermaster was advised concerning the adequacy of menus for men in these categories. Investigations were made of the quantity and quality of food issued to and served in messes, particularly with respect

to changes in dietary value and acceptability resulting from substitutions in the prescribed ration by issuing depots, from refusal of ration items by mess officers, and from improper issue, storage, preparation, and service of food. The Nutrition Branch participated actively in measures designed to increase the consumption of foodstuffs of special nutritional importance and to prevent waste of food and of the nutrients in foods. These measures included instruction in authorized training schools, drafting of directives, preparation of posters, and informal conferences with unit officers and mess personnel. Investigations and recommendations were made regarding the nutritional status and the food requirements of working and non-working prisoners of war and of other whose subsistence was the responsibility of the Army. Liaison was maintained with nutrition officers in allied military headquarters and with allied civilian nutrition agencies, and recommendations were made with respect to ration problems reported in Monthly Sanitary Reports. In general, the nutrition officer served as the representative and adviser of the Surgeon in matters pertaining to the medical aspects of rations and of mess operation and coordinated these concerns of the Medical Department with the related interests of other Services, particularly with those of the Quartermaster Corps.

Special Policies.--In addition to the general policies governing the activities of all Branches of the Division of Preventive Medicine, the Nutrition Branch adopted the following policies with respect to dietary standards and the character of rations in the theater:

a. The minimum standard for U. S. Army rations will be the daily allowances of vitamins, minerals, and other essential nutrients recommended by the National Research Council (Table 6).

b. Vitamin concentrates or tablets will not be authorized as supplements to the type A field ration if suitable foods are available to satisfy the vitamin requirements.

c. The desirability of fresh, natural foodstuffs will be stressed and rations consisting solely of processed components will not be approved except for limited periods of time.

Personnel.--A total of 30 Sanitary Corps nutrition officers, exclusive of those assigned to the Public Health Section, G-5, SHAEP, or to the European Civil Affairs Division, was sent to the theater during the 3 years subsequent to August 1942 (Table 1). Twenty of the 30 arrived before 6 June 1944, and participated in the pre-invasion planning and training in the United Kingdom. Most of

the officers were transferred to the continent during the summer and fall of 1944 (Table 1). The nutrition officers on duty in the theater were exceptionally competent and highly qualified by previous training and experience for the work of the Nutrition Branch. All had either completed or were engaged in post-graduate studies in Biochemistry, Physiology, Animal Husbandry or Food Technology prior to military service and were well versed in nutritional science. Furthermore, they had acquired indispensable practical knowledge of the duties of Army officers and of the problems of Army sanitation and messing through attendance at the School for Nutrition Officers at the Army Medical Center and through an average of 18 months service in camps in the United States.

Medical officers were assigned to the Nutrition Branch, Office of The Chief Surgeon, Hq. ETOUSA, for varying periods during 1945 and rendered valuable assistance as members of teams which investigated the nutritional status of recovered allied military personnel, prisoners of war and German civilians.

The proper location of the personnel of the Nutrition Branch was a vexing problem, particularly on the continent, because of the lack of provision for such officers in established Tables of Organization. As a result, it was frequently necessary to make assignments on the basis of greatest need. The distribution listed in Table 2 does not include many organizations in which opportunities for real service existed. For instance, only 2 of the 5 Armies in the theater, the Third and the Ninth Armies, made arrangement for the assignment of a nutrition officer on the staff of the Army Surgeon, and this was not done in the Third Army until late in 1944. Two officers were assigned to the Ground Force Reinforcement Command but were compelled to confine their activities to the depots to which they belonged even though their abilities would have been of inestimable service to other depots in the Reinforcement Command. Officers were on duty in 7 of 9 Base Sections established during the 12 months following the Normandy invasion but only 4 of the 7 occupied a position on the staff of the Section Surgeon. The fact that many officers were carried on an uncertain, attached basis rather than on permanent assignment was not only a handicap to the operation of a consistent long range theater program but was also unfair to the officers because deserved promotions were often delayed and, in some instances, impossible. In spite of this handicap the success of the nutrition officers was outstanding and the group received 12 awards.

The ratio of nutrition officers to troops in the theater during the first half of 1945 was 1:125,000. It would have been advantageous if officers had been available on not less than a

1:75,000 basis and if their distribution had been according to either of the following alternatives:

a. T/O assignment of one or more officers to each major headquarters, including Hq. ETOUSA, First, Third, Seventh, Ninth and Fifteenth Armies, Eight and Ninth Air Forces, Assembly Area and Ground Force Reinforcement Commands, and Base Sections.

b. Temporary duty assignments throughout the theater from an authorized theater pool, supervised by the Theater Surgeon and having an established T/O with suitable grades.

The second alternative has the merit of flexibility and would have permitted the temporary assignment of officers to armies and other commands according to troop strength and according to the occurrence of special problems related to the varying phases of activity of staging and of rest areas, of centers of hospitalization, of schools, and of prisoner of war enclosures.

Medical Department Dietitians.--One or more Medical Department Dietitians were assigned to each hospital in the theater, except field and 400-bed evacuation hospitals. The Nutrition Branch was not responsible for these officers, from an administrative standpoint but aided them in every possible way to carry out their functions more successfully. In some hospitals, dietitians were considered no more than assistants to mess officers and were handicapped in the performance of their duty of rendering professional assistance in the feeding of patients. The Nutrition Branch supported the professional standing of the dietitian and encouraged their participation in programs designed to improve the nutrition of hospital patients. Frequent conferences of dietitians for discussion of pertinent problems were arranged by nutrition officers at headquarters of base sections and hospital centers.

A dietitian was assigned to the Chief Surgeon's Office in May 1945, following a visit to the theater by the Chief Medical Department Dietitian, Office of The Surgeon General. There was real need of the services of this officer at headquarters and her assignment was a boon to the dietitians in the theater who previously had no representative in the Chief Surgeon's Office. The new Chief Dietitian was attached to the office of the Nutrition Branch, an arrangement which was mutually helpful.

THE NUTRITION OF THE UNITED STATES ARMY IN ETO

Troop Rations in the United Kingdom.

British and British-American Rations.--The first American units which arrived in Northern Ireland on 26 January 1942 were issued British rations and were loaned British Army cooks who familiarized American cooks with the ration components and with the stoves and other kitchen equipment. The same procedure was used as additional forces reached Ireland and England. The British Home Service ration (Column 1, Table 3), included a cash element of 2-1/2d (pence) per day which was used by British messes in the purchase of condiments and other items supplied by NAAFI. This dietary was soon found unsuitable for the American Army and the amounts of meat, grain products, sugar, evaporated milk and dried fruit were increased (Column 2, Table 3). Troops engaged in hard labor were authorized a 15% increase in this Augmented British or so-called British-American ration.

Table 4 shows the nutritive value of the British and British-American rations on an "as issued" and an "as consumed" basis. The latter values were obtained by making the following deductions from the "as issued" values:

a. The over-all average loss of foodstuffs during the issue, storage, preparation and service of the ration components is estimated as 5%. This is a minimum figure which is greatly exceeded in inefficient messes.

b. The quantity of uneaten meat fat and cooking fat is estimated as 25%.

c. Losses of thermolabile vitamins in cooking are estimated according to the National Research Council tentative recommendations listed in Table 5. These are minimum losses which are greatly exceeded in Army messes if food is overcooked or allowed to stand in warming ovens or on steam tables for long periods.

According to American standards and tastes, the British ration was unsatisfactory because of its low caloric value and low content of milk, egg, beef, pork, tomato products, canned fruits and fruit juices, and coffee. On the basis of consumption, it failed to provide the levels of calcium, riboflavin and ascorbic acid recommended by the National Research Council (Table 6).

The inadequacy of the Home Service ration for British troops was recognized by the British War Office and improvements were made in 1943 (See footnote 3, Table 4). The British-American ration was more than adequate in calories but was deficient in tomato products, fruits, and fruit juices. Its nutrient supply was greater than that of the British Home Service ration but, on a consumption basis, it failed to supply the recommended levels of calcium, riboflavin, and niacin.

Early Development of the American Ration.--American rations were authorized on paper in February 1942 but no menu was published and troops continued to receive either the British ration or the British-American ration. The components of the authorized type "A" field ration were the same as those of the garrison ration except that 4 oz. of wheat flour and 8 oz. of bread replaced 12 oz. of wheat flour (Column 3, Table 3). The listing of the garrison ration as the basic field ration in an overseas theater is inexplicable in view of the fact that the garrison ration was designed for the calculation of the monetary value and not for the issue of a ration. There was concern over the authorization of this ration because of its weight (4.55 lbs.) and caloric value (5127 Cal.), and in May a revised ration was published in which beef was decreased from 7.43 to 5.20 oz., potatoes from 10 to 8 oz., sugar from 5 to 4 oz., bread from 8 to 7 oz., and flour from 4 to 3 oz. These changes lowered the caloric value from 5127 to 4562 but still left the ration far in excess of the British Army ration so that pressure was continued to decrease the difference between the rations of the 2 armies. Undue attention was paid at this time to the weight of the authorized ration and to the shipping which would be required to transport it across the Atlantic. No consideration was given the fact that the list of components did not constitute an acceptable ration nor the fact that the weights were not significant because boneless meat would be shipped rather than carcass meat, dehydrated potatoes rather than fresh potatoes, evaporated and dried milk rather than fresh milk, etc. On 28 July 1942 the first menu was published by the Office of the Chief Quartermaster and this served as the tentative basis of issue to units adjacent to the relatively few depots which were in operation at that time. The ration prescribed by this menu was patterned after the Expeditionary Force Menu No. 1 with adjustments made to bring it into line with the authorized ration scale. The activation of Quartermaster depots proceeded rapidly during the early fall and units were transferred from the British-American ration to the American ration accordingly. This change-over was nearly complete by the end of October except for those units of the Air Force which shared stations with the R.A.F. At these stations either British or American rations were issued depending upon which force was numerically greater. It is interesting that neither group was satisfied with the ration to which it was unaccustomed.

American Air Force enlisted personnel at stations issued the British ration (not the British-American ration) were particularly unhappy and requests for supplementation of the ration with canned fruits and fruit juices were not infrequent. Supplementation in these instances was impracticable and was not approved. Fortunately this situation did not continue long because incoming Air Force personnel made possible the general issue of American rations.

Investigations by Nutrition Branch.--Early in the summer of 1942 the Chief Quartermaster realized the need of expert advice with respect to the ration, particularly if further decreases were in prospect, and requested the Chief Surgeon to designate an officer who could collaborate with the Subsistence Division on this matter. This was done immediately as a temporary measure and The Surgeon General was requested to provide a qualified Food and Nutrition officer. This officer arrived on 30 August 1942 and on 4 September 1942 was assigned to the Division of Professional Services as Senior Consultant in Nutrition. On the following day this activity was transferred to the Division of Preventive Medicine and the Nutrition Branch was established in that division.

The first menu for the type "A" field ration (Column 3, Table 4), which was published on 28 July 1942 as a tentative basis of issue, was authorized by the Theater Commander on 6 September 1942. The letter of authorization from Hq. ETOUSA directed that the services of the newly assigned nutrition officer would be utilized to make the best possible use of subsistence and that the contents of the proposed menu should be modified when justified by further study. It became the first duty, therefore, of the Nutrition Branch to determine the adequacy of the ration prescribed by menus prepared by the Subsistence Division and to recommend improvements, if necessary. The reports of the resulting studies of the first menu authorized on 6 September 1942 and of the second menu (Column 4, Table 4) authorized on 12 October 1942 paved the way for the subsequent complete revision of the ration scale upon which these menus were based. The reports, which were forwarded to the Chief Quartermaster and which served as a basis for the first of many regularly-occurring conferences at which theater rations were discussed and evaluated during the ensuing 3-year period, emphasized the following points:

(1) The caloric levels of the first and second menus were approximately 4800 and 4500 respectively, both of which were in excess of the actual energy requirement of troops. Adjustment of this level should not be accomplished at the expense of the nutrients of the ration.

(2) Forty per cent of the calories were from fat, a large part of which would not be eaten. Special measures to salvage unused fat were therefore necessary.

(3) The substitutive table which was patterned after the one described for the garrison ration listed vegetables, in general, as substitutes for plant sources of vitamin "A". In order to safeguard the adequacy of the ration it was essential that substitutes for leafy, green and yellow vegetables should be limited to vegetables in that category. Similarly, substitutes for tomatoes should be limited to tomato or citrus fruit products.

(4) Increased issues of fresh cabbage and potatoes, milk and tomato products were necessary in order to provide an acceptable ration.

(5) Menus should be used as an instructional medium for mess personnel and should include data on methods of conserving nutrients during the preparation of food, on the necessity of complete utilization of the nutritionally-important foodstuffs and on other pertinent phases of mess operation.

Waste of Food in 1942.---During November 1942 an extensive survey of American units in the United Kingdom was made by representatives of the Nutrition Branch, of the Subsistence Division, and of the British Army Catering Corps. This investigation demonstrated that the issue of excess food was resulting in widespread wastage because of failure to use the ration economically and to return unused items to depots. This was distressing, not only because it represented financial loss and the futile transportation of supplies across the Atlantic but also because of the unfortunate effect it had on the British who were campaigning for the maximum prevention of waste. The report of the Nutrition Branch discussed the fundamental problems as summarized below and recommended that necessary measures be taken as follows:

(1) To emphasize the responsibility of unit commanders for mess supervision and mess operation.

(2) To increase the waste-consciousness of the American forces.

(3) To increase the sense of individual responsibility for nutritional health.

(4) To strengthen and extend the facilities for the training of mess officers, mess sergeants and cooks.

Revision of Ration Scale.--On 12 December 1942 the Chief of the Nutrition Branch was specifically ordered to recommend whatever changes in the current directives on rations were deemed appropriate as a result of his investigations in the theater. As a matter of fact, the third menu, published 22 December 1942, was satisfactory in most respects because most of the earlier recommendations of the Nutrition Branch had been approved by the Subsistence Division, OCQM, and incorporated in the menu. The caloric level had been decreased temporarily to 3800 as a means of emphasizing the necessity of complete utilization of the ration. None of these changes were in accordance with the theater ration directive so that there was need of a restatement of the basic components and allowable substitutive items of the ration. Advantage was taken, therefore, of this golden opportunity to describe the field ration in terms of food classes composed of nutritionally similar foodstuffs (Column 4, Table 3). Substitutive items were rigidly restricted to those of nutritional equivalence and both basic components and substitutes were limited to those known to be available. The proposed new directive on rations was forwarded to the Theater Commander on 14 January 1943 and was published on 11 February 1943. Only minor changes in the troop ration scale were necessary in subsequent revisions of this circular.

Menus.--Separate menus were prepared by the Subsistence Division, Office of the Chief Quartermaster, for the type "A" field ration used in the United Kingdom through January 1945, at which time practically identical menus were authorized for the troops in the United Kingdom and on the continent. During the 25-month period from 1 January 1943 to 1 February 1945, 15 menus were published in the United Kingdom. These varied according to the seasonal supply of locally-available fresh foodstuffs and according to the levels of depot stocks. Substitutions for gas-forming foods were authorized for Air Force personnel. Subsequent to January 1944 each menu included a table showing the nutritional analysis of the prescribed menu, data on the more important nutrients, and a statement that the menu had been analysed by the Office of the Chief Surgeon and approved "as being adequate for the nutrition of troops if the food is prepared properly and eaten."

Average Type A Menu in the United Kingdom.--The composition of the average type A field ration issued in the United Kingdom between 1 January 1943 and 1 February 1945 is described in Column 1, Table 7, and its nutritive value in Column 5, Table 4 (Figure 2). Comparison of the "as consumed" value of this ration with the recommendations of the National Research Council (Column 4, Table 6)

shows that the ration was adequate in all nutrients except riboflavin which was 10% less than the recommended allowance. This was not believed significant and there was no evidence of ariboflavinosis in the troops. It is highly probable that 2.0 mg. of riboflavin daily are more than sufficient. From a practical standpoint it is very difficult to provide this level even in a varied diet containing meat, milk, and eggs without occasional servings of liver and without riboflavin-enriched flour and bread. Worthy of emphasis is the fact that U. S. Army rations in the United Kingdom contained neither white flour (70% extraction) nor white bread. British flour (85% extraction) and British bread were used and the consumption by the troops was very satisfactory (0.424 lb. daily). The average intakes of evaporated milk and of dried egg were the equivalent of one pint of whole milk and of one egg daily. Servings of cabbage and of brussels sprouts were in excess of American food habits. The average daily issue of all fresh vegetables, other than tomatoes and potatoes, amounted to 0.375 lb., 28% of which consisted of cabbage and sprouts (Figure 3).

Hospital (Patients') Ration.

The first theater directive on hospital rations in February 1942 authorized one field ration plus a monetary allowance of one shilling (approx. 20 cents) for the feeding of patients. Quartermasters were directed to procure the extra foodstuffs, requisitioned by hospital commanders, from "any available source." Later, hospitals were allowed to purchase food supplies for patients from local civilian sources as well as from the Quartermaster. The monetary allowance was unsatisfactory in the United Kingdom because of the very limited number of foodstuffs which could be procured by local purchase. Furthermore, requisitions from Quartermaster stocks did not guarantee a nutritious patients' ration except in those instances in which dietitians were delegated the responsibility for the expenditure of the cash allowance. For these reasons, the theater abolished the monetary supplement in February 1943 and adopted a special patients' ration at the same time that the revised troop ration was authorized (Column 1, Table 8).

The first patients' menu, effective 1 March 1943, was prepared by the Nutrition Branch. Subsequent menus were prepared by the Subsistence Division with the collaboration of the Nutrition Branch. In November 1943, the availability of supplies permitted revision of the hospital ration scale and small increases were authorized in meats, milk products, fruit juices and potatoes. These additions were offset by decreases in legumes and grain and the energy content remained approximately 4000 calories. Up to this time the majority of patients consisted of sick individuals without particularly hearty appetites (Figure 4). As more and more wounded Air Force personnel arrived in



Figure 2

The new field ration "A" of the European Theater of Operations, England, February, 1943.



Figure 3

An enlisted men's mess of an Ordnance Company,
England, January 1943.



Figure 4

The kitchen of the 298th General Hospital, Bristol, England, January 1944.

the hospitals, the ration which heretofore had been adequate required supplementation. Provision was therefore made for significant augmentation whenever necessary. Prior to D-day increases (Table 8) were authorized in the hospital ration in anticipation of the expected change in the type of hospital patient. The greater appetite and food consumption of average battle casualties compared with average patients is noteworthy (Columns 1 and 2, Table 10).

Between 1 Mar. 1943 and 31 Jan. 1945, 8 hospital menus were published. The menu, effective 1 Feb. 1945, was used without change through Oct. 1945. By this date practically all battle casualties had been evacuated to the United States. The hospital ration in the United Kingdom was never the same as that issued on the continent because of the greater supply of fresh meat and vegetables in England. Menus described the regular patients' diet only and the responsibility for special diets were required for 10 to 20% of the patients. Provision was made for modification of the ration issue whenever the need of special diets increased above 20%. This was the case if certain hospitals specialized in specific types of patients, such as those with hepatitis, with jaw injuries, etc. Provision was also made for the feeding of soup, sandwiches, egg nog, fruit juices and coffee at air strips receiving casualties by plane from the continent. Similar arrangements were made at so-called "transit hospitals" receiving casualties transported by water.

The special hospital ration used in the United Kingdom was composed of the items appearing in the troop ration (footnotes, Table 7) plus skimmed milk powder (for fat-free diets), malted milk powder, egg noodles, brown sugar, canned soups, purees, etc. It supplied 100% more chicken and fruit juices, 65% more milk, 20% more egg and 40% more fruit than the troop ration. The composition and nutritive values are shown in Columns 1 and 2, Tables 9 and 10, respectively.

Planning for Rations in Combat.

The continuation on the continent of the excellent ration supplied in the United Kingdom was impossible for many months after the establishment of a beach head. The enormity of the problem of transport across the channel and from beach depots to rapidly moving armies demanded the temporary use of nonperishable, conveniently packed, and easily prepared rations. Operational rations, such as C, D and K, and the nonperishable type B ration were already stocked in depots in the United Kingdom. Because the latter ration consisted of more than 100 different foodstuffs in as

many different containers, the Chief Quartermaster proposed the preparation of a so-called 12-in-1 ration which would supply in a single box an assortment of type B components sufficient for one day's supply of food for 12 men. The U. S. Army had used a 5-in-1 ration and the British a 14 man composite pack in North Africa. These had greatly simplified the subsistence of the two armies in the periods in which supply was difficult. Before more than a few units of the 12-in-1 had been assembled the theater was informed of the availability of the new 10-in-1 ration in the United States. The 10-in-1 appeared to fill the need for a ration intermediate between C and K and the type B ration and plans for the 12-in-1 were therefore dropped.

Combat Rations.--In order to familiarize the theater with the advantages or possible disadvantages of operational rations, a Ration Board headed by the Chief of the Nutrition Branch was appointed in 1943 and directed to conduct comprehensive field tests on rations which would be used later in combat. In the first of these field tests it was noted that troops remained in reasonably good physical condition during a 10-day period on C, K, and 5-in-1 rations but that the rations were deficient in calories, especially for large men (Figure 5). The report listed the following recommendations: the use of the D ration as a supplement only; the restriction of the use of C and K rations to 5-day periods unless supplemented; the replacement of the wholly unsatisfactory dextrose and malted milk tablets of the K ration with a desirable confection; the replacement of the fruit powder component of C and K rations with a source of ascorbic acid which would guarantee the utilization of this nutrient; and, the addition of cigarettes, gum, matches and toilet tissue to the rations which lacked these articles.

The report of the second trial noted the acceptable quality of the majority of the components of the recently developed 10-in-1 ration and the excellence of its packaging but emphasized its marked inadequacy in calories (3300-3400) for troops during 15-day maneuvers in moderately cool weather (35°-55°F). The following recommendations were made: an increase in caloric value to 3900 calories; a limitation of 30 days in its issue and of a total of 40 days in the issue of 10-in-1 and unsupplemented B rations; the replacement of the dehydrated baked beans, the fortified fruit powders, the K-1 biscuits and the dextrose and malted milk tablets; and, the addition of cocoa beverage powder, pea or bean soup powder, extra cereal mixture with increased sugar in the mixture, components for hot drinks twice daily, heating units, and extra paper towels.

The conception of the 10-in-1 ration was basically sound but it was obvious that it was developed for use in warmer areas than



Figure 5

A Ranger Battalion cook "5 in 1" rations during a field ration trial in Southern England, July 1943.

western Europe. Because of the demonstration of the marked caloric deficiency of this ration the theater decided to use it on an 8-man basis or to supplement it with additional food if it was issued on a 10-man basis.

Type B Ration.--The conviction that the physical fitness of troops would be impaired in the event future tactical situations required subsistence on unsupplemented operational rations for long periods also applied to the use of the type B ration. Early in 1944 the Chief of the Nutrition Branch spent 5 weeks observing the preparation, service and acceptability of this ration as issued to combat and service troops and hospital patients in North Africa and Italy. The adverse effect of the monotonous character of the unsupplemented ration was most impressive even though strenuous attempts had been made to improve its palatability following a survey by the Chief of the Nutrition Branch, Office of The Surgeon General, in November 1943. The unacceptability of the type B ration for continued use was primarily due to the unfortunate choice of its meat components. The least desirable of these, meat and vegetable hash, meat and vegetable stew, vienna sausage, and chili were served a total of 8 times in each 10-day period. The hash and stew aggravated monotony because they were also components which appeared daily in the C ration. The distinctive appearance and taste of the vienna sausage and chili made it exceedingly difficult for cooks to change the method of preparation. Luncheon meat, pork sausage, corned beef, corned beef hash, and salmon, which were served a total of 12 times in each 10-day period, were more satisfactory because it was possible for interested cooks to introduce variations in the product served.

In view of the fact that there was no certain way of forecasting the time which might elapse between the planned invasion of the continent and the opportunity of transporting fresh foodstuffs to the invasion troops, it was believed hazardous to disregard the experience of the North African Theater. Consequently, strong representations were made to the Chief Quartermaster to withhold approval of the type B ration and also of the 10-in-1 ration until it was demonstrated that the acceptability of the former and the caloric adequacy of the latter had been improved. Specific recommendations with respect to feeding troops on the continent included the following: shipment of bakery units and of fresh meat to the continent at the earliest possible moment after D-day so that the maximum period for subsistence of troops on wholly processed rations (D, C, K, 10-in-1, and B) would not exceed 40 days; substitution of canned roast beef or canned meats for less desirable components of the B ration; replacement of the butter substitute,

Carter's Spread; modification of the 10-in-1 ration as previously recommended; supplementation of C and K rations with miscellaneous nonperishable foodstuffs (sardines, peanuts, jam, etc.) as a means of avoiding monotony; supplementation of C and K rations with multivitamins after 15 days in the event these were the only rations available; and provision of individual heating units, preferably tablets of the "hexamine" type.

These efforts to improve the quality of processed operational rations were supported by the Chief Quartermaster and were successful insofar as the 10-in-1 ration was concerned. The theater was informed in April 1944 that the caloric value of the 10-in-1 had been increased from 3400 to 3700 and that in future procurement in the United States the ration would provide 3900 calories. These improved types were received before the termination of hostilities on the continent but improved C and K rations were not available until the later spring of 1945. Additional type B meat components, such as canned beef and gravy, pork and gravy, sardines, etc., were received but not until after the type B ration had been replaced by the A ration with its fresh foodstuffs. Individual heating units of the wax candle type were received but were little used because of their unsatisfactory character.

Although the highly successful course of the war following the invasion had removed the necessity of reliance upon operational rations for extensive periods, the efforts to bring about fundamental changes in these rations were continued. In July 1944, at the request of the Chief Quartermaster, the problem was discussed in detail with a representative of The Quartermaster General, to whom specific and general recommendations were made. The recommendations, which dealt with the basic considerations involved in the development and use of operational rations, emphasized the following points: impairment of nutritional status as a result of failure to eat rations which become unacceptable because of their monotony; the beneficial effect of variety and of the absence of highly seasoned foodstuffs on the avoidance of monotony; necessity of emphasis on optimum rather than minimum intakes of indispensable nutrients; assessment of the adequacy of an individual type of operational ration on the basis of the total period a soldier is expected to subsist on it and all other nonperishable rations; enrichment of operational rations, if necessary, so that it is a complete source of known nutrients; and, incorporation of nutrients in major ration components, if enrichment is necessary.

The indoctrination of medical officers, line officers and troops with respect to rations was aided by the publication of directives prepared by the Nutrition Branch. The first of these

described operational rations for the information of medical officers and emphasized the inadequacy of operational rations for continued use. The second was a theater directive to all officers to supervise the utilization of rations by troops so that the maximum consumption of critically-important foodstuffs would be achieved. The third was prepared for the briefing of invasion troops and consisted of material to be presented by company officers. The latter was subsequently the basis of an article in Warweek, a supplement to the Stars and Stripes devoted to preparations for the invasion of the continent.

Rations for Patients.--A supplementary ration for the nourishment of casualties in beach heads was essential because C or K rations were wholly unsatisfactory for this purpose. The procurement of such "patient's operational ration" was one of the first activities of the Nutrition Branch. The Quartermaster agreed to prepare cases, each containing fruit juice, milk, sugar and coffee for 20 men, if an equivalent ration could not be procured from the United States. Subsequently, the 25-in-1 hospital supplement was developed in the United States and was used with great benefit in Italy and in France. Procurement of this supplement became impossible in the spring of 1945 so that an additional quantity was assembled in the United Kingdom for use by the armies in Europe.

In addition to the 25-in-1, a second supplement, the B-C pack, was requested by the theater and supplied from the United States. This unit contained bouillon cubes and cigarettes and was designed for issue to aid stations. These components were selected following a survey of battalion medical officers in experienced divisions which had arrived in England from the North African theater. The value of this supplement was questionable, mainly because of the successful provision of other nourishment to front line units.

The final plan for the feeding of patients on the continent included the issue of rations as follows:

Battalion and Regimental Aid Stations and Collecting Companies - Troop Ration (C, K or 10-in-1) plus B-C units.

Clearing Companies and similar units - Troop Ration (C, K or 10-in-1) plus the 25-in-1 hospital supplement.

Field and Evacuation Hospitals - 10-in-1 or type B ration plus the 25-in-1 supplement.

Station and General Hospitals - Type B or type A ration plus hospital supplements.

Rations on the Continent.

Type C and K rations, supplemented with the D chocolate bar, were used on the continent until D/5, at which time 10-in-1 rations were available for issue to troops in rear areas. The latter ration was widely used until D/33 when type B components were distributed. By D/40 fresh bread and meat were issued in limited quantities. The supply of bread increased rapidly as new bakery companies arrived and went into production. The early establishment of bakeries on the continent and the movement of these with the Armies contributed immeasurably to the maintenance of the nutritional health of the troops (Figure 6).

Operational rations were supplemented with captured enemy foodstuffs and with fresh vegetables and eggs which were surplus in many districts of Normandy and Brittany. Shipments of potatoes and carrots were received from the United Kingdom after D/90 and, at the same time, arrangements were made with French authorities to obtain tomatoes, onions, celery and cabbage whenever these were in surplus of civilian requirements. The listing of fresh meat and vegetables in monthly menus of the modified Type A ration was possible starting with the September menu. It is estimated that about one-half of the meat and vegetable issue during the fall and winter consisted of fresh items. Combat troops and hospital patients were given first priority on fresh meats (Figure 7). The meat issue in the Armies was augmented by the capture of large cold storage plants well-stocked with carcass beef.

Vigorous efforts were made by the Nutrition Branch and by many Quartermaster officers to minimize the use of operational rations, except as emergency rations for front line troops. Supply officers were inclined to over-emphasize the convenience of transport and issue of the C, K, and 10-in-1 rations at times when convenience was not a tactical necessity. The justification for the use of the modified A ration with its hot, varied meals did not depend on a theoretical effect upon physical fitness and morals. These positive effects were real and were recognized by the personnel of experienced divisions (Figure 8). The contrast between old and new combat divisions in this respect was most enlightening. Table 11 shows the proportional use of operational rations on the continent. The extent of issue of nonoperational rations to combat, as well as



Figure 6

A field bakery in Belgium, 3026th Quartermaster Bakery Company, November 1944.



Figure 7

Loading refrigerator trucks with frozen meat for distribution to combat troops, Advance Section, Communications Zone, Homecourt, France, November 1944.



Figure 8

An abandoned German stable serves as a kitchen for members of the 36th Infantry Division in Alsace Lorraine, December 1945.

service troops, was most gratifying. It is significant that the "Battle of the Bulge," which occurred in an area easily supplied with A rations, did not increase the issue of operational rations (Dec. 1944 and Jan. 1945, Table 11). This is in contrast to the requirement of these rations in the period of rapid movement away from supply depots during the over-running of Germany (April - May, 1945).

The nutritive value of the operational rations (as issued) is shown in Table 12. In general, the data do not reflect the intake of nutrients because of the common failure to eat all of the ration. Troops were on a diet practically devoid of ascorbic acid whenever they subsisted on un-supplemented, C, K, or 10-in-1 rations in the cold weather which was general in Europe. This resulted from the refusal to prepare and drink the lemonade which may be made from the fortified lemon or other fruit powders. Table 12 describes the nutritive value of the improved 10-in-1 but not the improved C and K rations. Revised forms of the latter were on hand late in the war but the bulk used between D-day and April 1945 consisted of unimproved types. These were unpopular and were poorly utilized. Limited experience with the newest C ration indicated that troops preferred it to the K ration. The K ration appeared more desirable than the unimproved C ration except in units which made provision for heating the C ration (Figure 9). These units set up field ranges as close to the front as was feasible, heated the meat components of the C ration in boiling water, repacked the hot cans in cases and sent them forward for distribution. The taste of the C ration meat component is greatly improved if warmed.

The composition of the type A and B rations used on the continent is shown in Columns 2-5, Table 7. Infrequent but highly appreciated shipments of oranges and shell eggs are not included in the data in Table 7. The effect of these rare items on morale was tremendous and wholly justified the extra transport required for their procurement and distribution.

Considerable difficulty was experienced by the Quartermaster and by G-4 in maintaining complete stocks of type B components in depots and at railheads. Ships carrying "balanced" stocks of rations were sometimes moved, when partially unloaded, to make way for higher priority cargo on other ships. Railroad trains carrying balanced rations frequently lost one or more cars due to mishaps with the result that unbalanced or incomplete stocks arrived at railheads. Shortages of miscellaneous items, especially of salt and baking powder, were common during the first month of use of the B ration.

The nutritive value of these rations, as issued and as consumed, is described in Table 13. The deficiency in thiamine and the questionable deficiency in riboflavin in the type B ration (July, Column 1, Table 13) was corrected as quickly as fresh items became available. The ration was adequate by October 1944 and by February 1945 was superior in its content of nutrients to that supplied in the United Kingdom before D-day (Comparison of Column 4, Table 13 with Column 5, Table 4). The difference is primarily due to enriched flour, that used on the continent having a higher content of thiamine and riboflavin than the British National flour.

The data in Tables 7 and 13 do not include extra ration allowances authorized combat units occupying positions in contact with the enemy. These augmentations included a 10% overall increase for units receiving the A or B ration and additional meat, jam, bread and coffee ingredients for troops receiving operational rations. Full advantage was taken of these authorizations and the service of sandwiches and coffee to front line troops as supplements to C and K rations was a common occurrence.

In June 1945, rations for most inactive personnel, except patients, was automatically decreased 10%. Fortunately the ration was rich enough in nutrients so that minimum allowances were still supplied. Overall deductions are hazardous because of the failure to distinguish between foods of high and low nutrient content. The decrease in June was necessitated by the theater shortage in rations. It should be noted in this connection that the average ration was insufficient for units performing very heavy labor and required augmentation (See Page 22).

Hospital Rations.--The feeding of battle casualties was quite satisfactory. The rapid evacuation to the hospitals in the United Kingdom, both by air and by water materially eased the load on the medical units which preceded general hospitals to the continent. The result was that operational hospital rations were only required in the early stages of the invasion (Figure 10). Most of the casualties arrived very quickly in areas where type B or A components were available. The composition and nutritive value of the hospital rations on the continent is shown in Columns 3-6, Tables 9 and 10 respectively. The hospital ration on the continent differed from that in the United Kingdom in that the continental ration consisted of the troop ration plus a supplementary list of foodstuffs whereas patients in the United Kingdom were supplied a separate special ration. The continental issues were generally excessive unless hospital mess officers refused components of the troop ration which were not needed. The "as



Figure 9

A wireman of the 57th Signal Battalion heats "C" rations for his crew, Hochfelden area, France, January 1945.



Figure 10

A kitchen under canvas feeds 1200 patients of the
167th General Hospital, Tournlaville, France, January 1945.

consumed" data in Columns 3-6, Table 10. do not include the significant quantities of unused hospital rations and are therefore larger than the actual consumption. Column 2, Table 10, gives a more accurate picture of the food consumed by patients. This was a particularly successful ration which supplied the needs of the sick and of casualties with the minimum of waste. The authorization for the use of the special hospital ration on the continent was refused by headquarters for the reason that depots would find it too difficult to provide two rations rather than one ration plus a supplement. As a matter of fact, the Nutrition Branch found it necessary to investigate constantly the issue of the supplement in order to be sure that it was received by the hospitals.

The objections to the meat components of the type discussed on page 15 applied with even greater force to the feeding of casualties. The additional variety provided by meats in the hospital supplement was far from that which is desirable in patients' diets. In this respect the hospital ration of the Expeditionary Force Menu was most unsatisfactory.

Augmentation and Reduction of Rations.

In August 1942 authority was granted the Commanding General, SOS, ETOUSA, to increase the "Augmented British Ration" (British-American Ration) 15% if not less than 75% of an organization was engaged in hard physical labor for 10 or more hours daily, 6 days per week. This augmentation ceased as troops received the American ration in September and October of 1942.

Early in 1943, upon the request of the Air Force Surgeon, members of Air Force combat crews on operational status were authorized 3 fresh eggs and 3 oranges per man weekly and 0.0625 lb. of powdered whole milk daily. Later, Air Force combat and repair crews on operational status were allowed the following augmentation:

<u>Item</u>	<u>Lbs. per 1000 rations</u>
Meat, canned	68.8
Fruit Juice, canned	108.2
Fruit, canned	61.7
Coffee (R and G)	6.9
Milk, evaporated	9.1
Bread	28.6
Butter	6.9
Sugar	9.2

The request for shell eggs and oranges was approved by the Office of The Chief Surgeon as a morale measure and not because of nutritional necessity. The request for components for a fourth meal was granted by the Theater Commander without the reference of the matter to the Chief Surgeon for investigation and recommendation.

In view of the increasing number of requests for augmentation of rations, mainly from port and engineer battalions, an extra allowance for units performing arduous tasks was written into the theater directive on rations. Nutrition officers had been assigned to the staffs of Base Section Surgeons by this time so that it was possible to make the augmentation contingent upon an investigation by the Base Section Surgeon which "shows that the authorized ration issue is properly prepared, served and eaten and that a need for additional food still exists." The augmentation, which supplied approximately 400 calories, was purposely limited to bread or flour, potatoes and lard, although most units which requested extra food desired more meat. The basic ration was adequate in nutrients and generous in its meat components and it was believed to be sound policy, therefore, to confine supplements to reasonably available foodstuffs which provided the necessary calories. Units which were not interested in eating more bread and potatoes were not considered to be suffering from a shortage of food. As a matter of fact, few of the requests for augmentation were found to be justified. These investigations by nutrition officers did prove to be excellent opportunities for instruction of untrained or careless mess personnel.

The above procedure which provided for a thorough survey of the physical well being of troops as well as a determination of the adequacy of the quantity of the ration issue was a most satisfactory method of controlling the vexing problem of ensuring that soldiers were well-fed without incurring the risk of waste of food because of over-supply. Unfortunately, it became necessary in July 1944 to replace this system with one which liberalized the issue of augmented rations and recognized the fact that it was easier to supply extra food to a unit than it was to insist upon efficient mess operation. Prior to the invasion of France requests for augmentation of the ration increased enormously due to the number of depot and port units which ran day and night shifts. Some units attempted to feed sandwich meals at night rather than hot meals prepared by a night shift in the mess. The ration was not adapted for sandwich meals at night rather than hot meals prepared by a night shift in the mess. The ration was not adapted for sandwich meals. Night feeding was poor therefore, and vegetables, canned fruits, etc. accumulated in storerooms. In other units, which served regular hot meals at midnight, men on the night shift were permitted to get

up and eat the midday meal with the day shift. The total daily food intake of these men was no greater but this practice did deprive the day shift of its normal share of the more desirable components of the ration, especially of its share of the meat issue. Artificial shortages of certain ration items developed from these failures of mess officers to insist upon mess discipline and proper mess operation. During this period the Commanding General of the Theater Services of Supply believed it necessary to authorize many augmentations without the usual preliminary survey. All investigations were therefore discontinued and augmentation requests were approved as they were received. As soon as the emergency created by the main invasion operations had passed, the augmentation procedure was brought under control again by a new directive which rescinded all previous written and verbal authorizations for extra rations and which described the specific types of augmentation which might be requested. The ration increases for the Air Force, referred to above, were reaffirmed. An automatic increase of 10 percent was allowed messes serving less than 50 men in order to provide adequately for the many isolated anti-aircraft and similar groups consisting of 5 to 20 men. The Chief Quartermaster was authorized to grant extra food to troops engaged in hard labor to noncombat sectors, to troops returned to rest camps after combat and to troops operating under exceptional circumstances provided the Chief Surgeon recommended the augmentations as essential for the maintenance of physical fitness. These types of augmentation were listed:

- a. 10% increase in all ration components.
- b. Daily sandwich meal consisting of the following:

<u>Item</u>	<u>Lbs. per 1000 rations</u>
Meat, canned	180
or	
Cheese	90
Bread	180
Sugar	30
Coffee (R and G)	40

- c. Daily fourth meal consisting of the following:

Beef, boneless (B and S)	300
or	
Beef, boneless (G)	300
or	
Beef, corned, canned	240
or	

Eggs, dehydrated	50
or	
Pork, boneless	270
Potatoes	300
Bread	120
Coffee (R and G)	40
Sugar	30
Jam	60
or	
Marmalade	60

(Issues of meat and egg components were rotated.) In addition, division or similar commanders were authorized to grant the following increases to troops actually occupying positions in contact with the enemy.

a. For troops subsisting on the type "A" or "B" ration: the 10% overall increase, the sandwich meal or the fourth meal described above.

b. For troops subsisting on type "C", "K" or "10-in-1" rations, the following daily augmentation:

Meat, canned	180
or	
Cheese	90
Jam	60
or	
Marmalade	60
Soup, dehydrated	40
Coffee (R and G)	40
Milk, evaporated	45
Bread	180

Further provision, as follows, was made in October 1944 for an adequate daily supply of coffee for field and air force units engaged in operations on the continent:

Coffee (R and G)	40
or	
Coffee, soluble	16.8
Milk, evaporated	45
Sugar	30

This augmentation was continued through the winter months.

The listing of specific augmentations which included meat naturally resulted in a flood of requests, most of which were sent to headquarters with no justification other than that mess officers thought they should obtain "all that the law allowed." The directives admirably ensured satisfactory rations for small units which needed the 10% increase and for combat troops which needed supplements to operational rations. However, the responsibility of the Nutrition Branch of the Chief Surgeon's Office for recommendations regarding augmentation requests from units not in contact with the enemy placed a heavy burden on that office because many areas on the continent were not covered by section nutrition officers. It was necessary to approve many requests without investigation of their justification and then to survey the units as time permitted. In this respect, the 30-day limitation on each approved request proved particularly valuable.

In June 1945 the theater ration and augmentation directives were drastically revised. The new directive, which took into consideration the cessation of hostilities and the critical shortage of rations within the theater, included the following provisions:

a. All augmentations were discontinued except the 10% increase for small messes (under 50) and increases for crews of small water craft. The way was left open for augmentations which were approved by the Chief Surgeon but it was emphasized that nutritional necessity, and not convenience in mess operation, would be the sole factor governing the approval of an augmentation request.

b. Decreases in normal ration issues were authorized for the first time in the theater:

- (1) Rations for all military personnel engaged in sedentary duties were automatically reduced by 10%.
- (2) Base Section and other Commanders were directed to review constantly troop lists in their respective commands and to apply reductions up to 10% for all troops engaged in light or moderately active duties.
- (3) A percentage reduction, as follows, was directed for all messes not affected by the provisions of par. a and b, above:

<u>Strength of Mess</u>	<u>Percentage Reduction</u>
Over 1000	7
30 - 1000	5
Under 300	0

None of the above reductions applied to ration items, such as shell eggs or fruit, issued on the basis of one per man. Furthermore, personnel in the following categories were exempted from all reductions: Hospital patients; troops undergoing vigorous training or engaged in hard labor; troops on leave or in officially designated rest areas; messes serving less than 50 men; and, recovered allied prisoners of war (RAMP's). Certain readjustments were recommended by nutrition officers from time to time as units were found to which ration reductions had been applied even though the units required full ration issues. This difficulty arose from the tendency of Section Commanders to follow the convenient administrative procedure of ordering 10% deductions for all units instead of directing nutrition officers to investigate and to recommend proper action.

The adjustment of the ration according to the needs of troops who are engaged in work, training or combat with extreme gradations of physical activity and who are exposed to varying living and climatic conditions is a complicated problem which was not solved by any of the methods used in the theater. The established Army procedure of providing a single ration with percentage increases or decreases has the merit of convenience and, certainly, there are periods of emergency when the convenience of the transport and issue of a single ration becomes a most important factor. Nevertheless, there is little justification for the issue of the same quantity of food to one who spends his day at a desk under reasonably comfortable conditions and to another who may be working or marching in the rain or snow. If the ration satisfies the needs of the latter, surplus rations are issued to the former. Surplus rations always favor wastage and permit unwise selection of individual ration items both in the preparation and in the service of meals. Food would be saved and troops would be better nourished if ration issues were based on nutritive requirements rather than on convenience of issue. This is especially true if the term "convenient" is used loosely to refer to a procedure to which one happens to have become accustomed.

The problem could be simplified by recognition of the fact that the main variable in the feeding of adult men is the caloric requirement. The fundamental error in overall deductions lies in the fact that all foodstuffs, regardless of their content of nutrients and of calories, are decreased to the same extent in

order to decrease the energy value. The intake of some nutrients, notably thiamine, should vary according to the caloric metabolism but this would never be a problem if bread prepared from vitamin-enriched or from high extraction flour were used as the principal source of energy in supplements to a basic ration which furnished the vitamins, minerals, protein and calories required by the group of troops engaged in sedentary duties.

Section on Food and Nutrition in Monthly Sanitary Reports.

Monthly Sanitary Reports which contained pertinent comments on rations, messing or nutritional status of military personnel were routinely referred to the Nutrition Branch for information and action. Relatively few problems were brought to light in these documents because of the activity of theater nutrition officers in recognizing and solving difficulties before it became necessary for medical inspectors to include them in their reports. Those problems that did appear in Sanitary Reports usually dealt with the possible need of ration augmentation. The original theater directive on Sanitary Reports required comments "on the extent to which food is properly prepared and served and on the adequacy of the food consumed by the soldier." This was subsequently expanded to include data on the following points: type, quantity and quality of the ration issue; adequacy of storage facilities; competence of mess personnel; the conservation of nutrients by proper cooking procedures; conservation of foodstuffs; and, the nutritional adequacy of the ration. Later, additional comments were called for concerning the necessity of vitamin supplementation and the need of nutritional rehabilitation in the case of troops required to subsist on emergency rations for prolonged periods. The insistence upon remarks covering a reasonably extensive list of nutritional topics had unquestionable merit in view of the unfortunate tendency of many medical inspectors to take messing for granted. In this respect, the procedure outlined above became a valuable instructional device insofar as new and inexperienced inspectors were concerned.

Vitamin Supplementation.--The supplementation of rations with multivitamins was a relatively unimportant feature of rationing in ETO except in the case of hospital patients and Air Force personnel. The former required extra vitamins if the food intake was insufficient to provide the necessary levels of these nutrients. Combat crews were supplied multivitamins at the request of the Air Force Surgeon. This may have been justified as a preventive measure related to a possible greater need of certain nutrients by aviators. The basis of such a need was never demonstrated.

In Feb. 1944 a survey of the dietary histories of the personnel of small detachments (1-15 men) of the Corps of Military Police, Finance Department, and Transportation Corps, located in cities, towns and villages throughout the United Kingdom, showed that the intake of vitamins was well below the minimum standards. These men were isolated from U. S. Army messes and received a monetary allowance in lieu of rations. Obviously no control of their purchase of food was possible except that of the British rationing regulations. Arrangements were made to supply multivitamins to these detachments although no evidence of nutrient deficiency was uncovered.

Provision was made for distribution of vitamins to combat troops in the event subsistence on unsupplemented rations continued for periods in excess of 15 days. Fortunately, few units were ever in this category. Conferences with division surgeons disclosed that few believed that vitamin supplementation was necessary. These conferences always served the purpose of re-emphasizing the desirability of extending even more the common practice of augmenting operational rations with sandwiches and other items.

The use of multivitamins in the nutritional rehabilitation of recovered prisoners of war is discussed on Page 32.

Malnutrition in Recovered Allied Military Personnel.

Prior to the crossing of the Rhine by allied forces, the location of the German prison camps for allied military prisoners was fairly well-known. Forecasts were available of the expected population of these camps but there was little information concerning the conditions in the camps. The reports from the International Red Cross were meager and sketchy and, as later investigations were shown, were inaccurate in their descriptions.

The immediate problems in the overrun camps were those of rectifying the prolonged and previous negligence of the German government and primarily involved sanitation, delousing, adequate living quarters, and nursing care with adequate medical supplies. Nutritive rehabilitation was almost universally required by all prisoners, ambulatory and hospitalized. One would usually find the prison hospitals loaded to capacity with from 50-400 patients and many hundreds more who should have been hospitalized but for whom facilities were not available, although it should be said that hospitalization in many of the prison camps was merely a word and not actual medical care as practiced in the American army. The insatiable desire for food on the part of these RAMP's had to be



Figure 11

American prisoners of war liberated by the Third Army in Fuchsmuehl, Germany, after a thirty-five mile forced march from Bad Orb, labor in a salt mine and a starvation diet, April 1945.



Figure 12

Americans in their prisoner of war quarters after liberation by the Third Army, Germany, May 1945.

satisfied. The generosity of the overrun units at times in distributing the food was really detrimental to these prisoners. The ingestion of operational rations such as C, K and 10-in-1, almost universally precipitated acute gastro-intestinal upsets with disastrous results. This resulted in an increased load of patients on the forward hospitals and evacuation systems. The field and evacuation hospitals performed their unexpected tasks in a superior manner. The evacuation of the sick and wounded was prompt and efficient, usually by air to communication zone general hospitals. Those who were evacuated by the British in the northern German sector were flown back to the United Kingdom directly by the RAF. The first evacuation of non-hospitalized RAMP's from liberated camps in the American sector was by air to Camp Lucky Strike (near Le Havre), which had been designated as RAMP Camp #1. From the point of view of the medical department it was these RAMP's, evacuated through command channels, who presented the greatest problems. The coordination finally achieved by the Provost Marshal's Office and the Office of the Chief Surgeon made acceptable supervision of this group possible. This first group presented a difficult therapeutic problem because they were the sick prisoners who were incapable of making forced marches required by German evacuation of the camps. The farther inland the advancing allied armies went, the farther back the Germans marched the bulk of the prisoners with the rapid weeding out of the sickest who were then recovered by the Allied armies. About the 25th of April 1945, word was received that the Ober Kommandantur of the Wehrmacht had agreed to stop the mass evacuation of the military prisoners from threatened prison camps. This agreement alleviated a good deal of the suffering which the prisoners were being subjected to by the forced marches away from the liberating armies. Consequently, the bulk of the allied military prisoners were recovered shortly thereafter. The total number of American RAMP's was over 83,000.

The initial survey of German stalags at Limburg, Zigenheim and Heppenheim by the Nutrition Branch revealed the magnitude of the RAMP problem and furnished the background for the measures adopted to ensure nutritional rehabilitation of the men (20% of total) who required immediate hospitalization or who were hospitalized during or after evacuation to the camps in the rear areas and of the men (80% of total) who, although suffering from malnutrition, were not hospitalized and remained under the control of the Theater Provost Marshal. A directive was immediately distributed to hospitals outlining therapeutic dietary procedures for the various categories of malnourished patients. The nutritional care of non-hospitalized RAMP's was effected by

the authorization of a special bland, high protein, high calorie ration for use in RAMP camps. Conferences were held with Base Section Surgeons and with medical officers in these camps in order to guarantee the proper use of the bland diet. This dietary regime was necessary because of the extreme gastro-intestinal sensitivity which characterized RAMP's. Diarrhea was almost universal before corrective measures were instituted. This is illustrated by the following data on the first RAMP's who were flown to the Lucky Strike RAMP camp after the screening out of all who required immediate hospitalization in the forward area. Out of 4800 men, 260 required hospitalization upon arrival at the air strip near the camp and 564 were hospitalized upon arrival at the camp. The morning sick call rate prior to the introduction of the bland diet represented nearly 20% of the population of the camp. Of all of these hospitalizations, 80% were due to gastro-intestinal distress. After the institution of the bland ration, the morning sick call rate dropped to 4%. The beneficial effect of the planned dietary regime is evident from the fact that on 14 April 1944, before ration control was effective, 749 out of the camp population of 2850 were hospitalized, whereas on 18 May 1945 only 1300 out of 48,334 required hospitalization. The irritating effect of unrestricted rations in RAMP's is also illustrated by an incident in one of the temporary RAMP camps in which 150 men out of 1000 required hospitalization following the ingestion of one meal of the 10-in-1 ration. It was necessary to prohibit the distribution to RAMP's of peanuts, candy bars, doughnuts, etc., by the Army Exchange Service and by the Red Cross because it was evident that these well-intended measures were in reality harmful. Studies of nutritional rehabilitation in the RAMP camps were not undertaken because it was the original policy of the theater to evacuate these troops to the United States immediately. Provision was made for the continuance of the bland ration on the ships carrying them home.

The RAMP policy in the United Kingdom differed from that on the continent in that all who arrived (by air) were placed in hospitals for quarantine and screening purposes. Otherwise, the medical problems encountered were quite similar. The 15th Hospital Center reported 999 admissions with malnutrition listed as the primary diagnosis in 412 and as the secondary diagnosis in the remainder. The diagnosis was based upon weight loss, edema, gastro-intestinal disturbances of a non-infectious origin, scarlet tongue, calf tenderness, and paresthesia of the hands and thighs. The 83rd General Hospital admitted 250, one of whom reported a weight loss of 101 lbs. Dependent edema in the absence of cardiac failure or of renal disease, glossitis, cheilosis, paresthesia, and scars of healed skin ulcers were observed. Edema, which disappeared later occurred during therapy. Laboratory findings showed low serum proteins, low red cell counts, and negative stool cultures. At the 97th General Hospital the syndrome of fever with negative chest X-ray and absolute leukopenia was observed. This hospital admitted 15 RAMP's with a diagnosis of hepatitis and malnutrition. In this hospital also, the temporary appearance of edema during therapy was noted. The 91st General Hospital reported a 20% incidence of atypical pneumonia.

Malnutrition - Types and Treatment

Malnutrition in RAMP's was classified as simple malnutrition, emaciation due to prolonged starvation, and acute starvation. Available records list not more than 6 fatalities occurring in U. S. Army hospitals as a result of malnutrition in these forms. Whether permanent impairment occurred in any of the vast majority who apparently recovered satisfactorily is, of course, not known.

Simple Malnutrition.--The largest group suffered from mild or moderate malnutrition and were not hospitalized unless gastro-intestinal distress was severe. This group did not show clinical signs of malnutrition other than loss of weight and gastro-intestinal sensitivity. That the diarrhea which was so common was generally not of infectious origin was demonstrated by the failure to find positive stool cultures in the majority of stool examinations. The character of the abnormality of the alimentary tract is illustrated by the report of the 217th General Hospital on a group of 25 RAMP's selected for X-ray examination. This showed puddling, segmentation, gas, and loss of normal markings in the small bowel. Delayed emptying time was universal. It is pertinent that nausea and vomiting were uncommon. One post-mortem examination showed general atrophy of the mucous membrane and atony of the musculature of the small intestine which was smooth and erythematous. Ulcerations were present in the large intestine.

Emaciation Syndrome.--In the malnutrition which leads to the emaciation syndrome, the intake of fluid and of calories are sufficient to ensure prolonged survival but insufficient to maintain a normal metabolic level. The outstanding deficiencies in calories and in protein account for disappearance of body fat and for the extreme wasting of the muscles. The patient as seen in the late stages presents a characteristic picture. One observes a completely apathetic very thin individual, usually lying immobile. The legs are flexed on the abdomen and the arms folded across the abdomen or chest. This position of the arms and legs is maintained even if the patient is rolled on his side. There is no true ankylosis of the joints as the patient can with much effort and persuasion extend his lower extremities to their full length. This is apparently a very painful process and is not done willingly. The skin is dry, coarse and cold to the touch. The extensive atrophy of all the muscles is one of the most striking signs. The legs and arms are apparently merely the bony contours of the long bones covered by skin. The buttocks are concave and follow the

contours of the ilium and ischium. In fact the bony prominences of all bones including the skull stand out so that the term "skin and bones" becomes a true description rather than a metaphor. Closer examination reveals evidence that this atrophy is universal. The face shows very sparse hair growth. The voice may be quivering and high pitched. These secondary sex character changes are very common in the late stage of the emaciation syndrome and undoubtedly reflect the universal physiologic atrophy of the endocrine system. The pulse rate is slow and respirations are shallow and slow while the patient is resting. The slightest excitement or activity precipitates a dyspnoea and tachycardia, indicating an extremely limited cardiac reserve. The eyeballs are soft and the conjunctivae wrinkled. There is a marked enophthalmus and dry eye. One frequently sees a malar flush, cyanotic in hue. The lips will vary in color depending upon the relative amount of anemia. While there is an absolute depression in the amount of hemoglobin, the heom-concentration may give an apparently normal hemoglobin. The tongue is usually smooth and beefy red. The size will vary. There may be many fissures. The gums as a rule present a fairly normal appearance except for color change. Deep tendon reflexes will vary from marked hyperactivity to complete absence and, because of the painful joints, it is difficult to evaluate them properly. Blood pressure is usually very low. Anal incontinence is very common and is manifested by the fecal incrustations in the gluteal folds (Figure 13).

These people represent physiologically, a hibernating stage of protoplasmic mass. They weigh from fifty to seventy-five pounds. The greater part of this weight is represented by metabolically inactive skeletal structure. The daily caloric requirements are apparently in the range of from four hundred to seven hundred. This explains the absence of florid clinical manifestations of nutrient deficiencies. Those who manage to accommodate to the reduced nutrient intake by a compensatory decreased metabolic level survive for surprisingly long periods.

The adjustment of the circulatory system and other physiological processes is a very narrow one and the integrity of life is dependent upon not upsetting this balance too abruptly. It must be recognized that these people continue to live only because they have developed minimal metabolic processes.

Enthusiastic therapy, abruptly started in an attempt to restore these patients too rapidly to their previous state of normal, may result in a breakdown of these compensatory mechanisms. Therapy must be started very cautiously, and with the recognition of all of the factors involved. Certain of the vitamins function



Figure 13

American soldiers captured during the "Battle of the Bulge" receive medical care following liberation from the prison hospital, Fuchsmuehl, Germany, April 1945.

as essential components of enzyme systems in carbohydrate and protein metabolism. With metabolic levels at a minimum, the demand for these vitamins is also very low. When, however, one burdens the body with a sudden plethora of foodstuffs, the vitamin requirements immediately increase proportionately, and unless this new requirement is fulfilled, acute deficiency results. In addition as has been pointed out the cardiac reserve is limited. A sudden change in the circulating blood volume throws a burden on the atrophic flaccid degenerated cardiac musculature with which it cannot cope. Therapy then is directed towards first supplying the vitamins of the B complex, then protein, and eventually complete caloric and nutrient definitive therapy. Experience has shown that oral administration, when tolerated, is the route of choice. Intravenous therapy is advisable only in the presence of nausea, vomiting or intractable diarrhea. Milk and egg mixtures, either fresh or powdered, are well tolerated by the majority. No attempt should be made for the first twenty-four to forty-eight hours to do more than re-educate the gastro-intestinal tract to the acceptance of these foods. No more than 1500 cc. of fluid mixture should be given by mouth in each of the first two twenty-four hour periods of treatment. If nausea or vomiting is precipitated by the oral administration then intravenous therapy should be instituted. Here, more than ever, extreme caution must be used. No more than 500 cc. of normal human plasma or blood should be given in the first twenty-four hours, and at a rate no faster than two cc. per minute, preferably slower. These patients are extremely sensitive to the intravenous administration of fluids and a very high percentage of reactions will be seen. Thiamine and niacin should be given regularly in the dose of 30 mg. of the former and 500 mg. of the latter in each twenty-four hour period. Oral therapy should be carried out as soon as is feasible. Such foods as cooked cereals, custards, white bread and dairy butter, mashed potatoes and thin soups are added slowly according to tolerance. In other words all foods must be low residue, mechanically non-irritating, and bland, for several weeks in order to avoid precipitating acute gastro-enteritis. Autopsy material lends credence to these clinical observations. At postmortem one sees an atrophic mucous membrane of the whole gastro-intestinal tract. There is loss of the normal folds and the surface is smooth, hyperemic and not infrequently ulcerated. Ulcerations are most commonly found in the large bowel from the ileocecal valve down to the anus. Once recuperation has started and the patient has demonstrated his ability to tolerate therapy, then more active treatment can be instituted. Plasma, twice concentrated, can be given intravenously to the extent of 500 to 750 cc. daily. Whole blood in the presence of severe anemia will speed the convalescence. Iron therapy is of

no value until a positive nitrogen balance has been well established. In addition, iron salts by mouth are notorious for the gastro-intestinal upsets they produce. Vitamin therapy is only supplementary to the high protein, high caloric intake, but it is a necessary adjuvant. The first oral feeding will frequently determine the speed of convalescence. Should the food produce an enteritis or gastro-enteritis, convalescence will be greatly prolonged and therapy made more difficult.

The emphasis cannot be placed too strongly on the clinical evaluation of the gastro-intestinal and circulatory aspects of these patients with total emaciation. It may be redundant to say again that many of these patients are in a precarious state of balance. The circulatory collapse secondary to violent retching and vomiting may precipitate death, just as readily as the injudicious use of intravenous fluids. The nasal or stomach tube, while theoretically of great aid in these patients, may lose its importance in actual practice. The struggle which some patients manifest against the introduction of this device may overtax their strength and precipitate a collapse.

Edema is not an infrequent finding during the intermediary stages leading up to emaciation syndrome. This edema varies from dependent lower extremity swelling to an anasarca. The edema is usually due to low serum proteins, values as low as 1.8 gm.% having been observed. If the gastro-intestinal tract can tolerate the bland diet regime, it is simple to get the patient to ingest a hundred and sixty grams of protein daily in the form of milk and egg drinks. Mild cases of edema will disappear in a few days with this high protein intake. Severe anasarca will take a somewhat longer time but diuresis will be manifest by the second day. Intravenous therapy is generalized anasarca is again a matter of clinical judgment. If nausea and vomiting preclude the oral intake of food, then the parenteral route must be utilized. A preliminary injection of 250 cc. of normal strength plasma may be given very slowly, to determine the patient's tolerance. If tolerated very well then double strength plasma should be started very slowly. It will usually be found that the patient will tolerate no more than 1000 to 1500 cc. a day. The use of more fluid intravenously before diuresis sets in will only result in an exaggeration of the edema. One must be constantly guided by the pulse rate, respiration, precordial distress, nausea and urine volume output as clinical indices to the intravenous therapy.

Very emaciated patients may have surprisingly low plasma proteins without edema. If rehydration occurs at a faster rate than restoration of plasma proteins, temporary edema occurs. The lack of

correlation between plasma protein and edema in severe emaciation is probably related to a state of dehydration in which new equilibria control the distribution of water and electrolytes between blood and tissues.

Acute Starvation.--In contrast to the picture of chronic emaciation is the clinical syndrome of acute starvation. By this is meant that condition in which the individual has been completely deprived of food and of fluid for several days. In this acute condition ketosis, acidosis, and marked dehydration occur. These patients require intensive therapy as quickly as it can be tolerated. Intravenous fluids with emphasis on the glucose-saline mixtures is indicated. No special dietetic therapy is necessary except that which secondary conditions require. Recovery is usually prompt and complete.

Other Ration Problems

Milk and Ice Cream.--Milk issues consisted almost exclusively of evaporated and dried whole milk. Small amounts of skimmed milk powder were included in the hospital ration for use in low-fat diets. One shipment of 3200 quarts of frozen whole milk was received in good condition in the United Kingdom in March, 1945, and was distributed to hospitals. Beverage milk and eggnog were prepared and served in hospitals but no serious attempt was made to popularize the use of beverage milk in troop messes although suitable instructions for its preparation were published in mess bulletins. The dried whole milk was very acceptable, however, and yielded a reasonably good fluid milk if care was used in its rehydration and particularly if the product was flavored with chocolate or vanilla. In view of the lack of apparatus for the large scale reconstitution of fluid milk from milk powder, emphasis was placed on the utilization of dried and evaporated milk in cooking, in cocoa, on cereal and in similar ways. Consumption of the milk component of the ration was satisfactory. This would not have been the case in the absence of an intensive educational program.

Early ration directives authorized the daily issue of the equivalent of 5 ounces of evaporated milk per man. This was not considered sufficient and the Nutrition Branch was instrumental in having the allowance increased to 7 and 10 ounces, and later to 8 and 12 ounces, for troops and hospital patients respectively. Thus, troops received the equivalent of one pint of whole milk daily. The additional milk added greatly to the acceptability of the ration and assisted materially in assuring satisfactory intake of calcium and riboflavin.

The use of fresh milk from local sources in the United Kingdom and on the continent was restricted and later prohibited because of the medical hazard involved and because of the scarcity of the supply for civilian use. The original directive in January 1942 stated that "fresh milk will not be used except when boiled in cooking, unless it is definitely established that it has been pasteurized, stored and delivered in sanitary containers." In September, 1942, the use of fresh milk was practically prohibited by an order which required that milk could be procured only if herds and processing plants conformed to U. S. Army standards. In November, 1943, the directive on milk was included in a more general order which prohibited the purchase of poultry, meat, meat food, marine and dairy products from commercial sources in the United Kingdom and on the continent. Subsequent ration directives did not change this policy insofar as U. S. military were concerned.

The manufacture of ice cream by British concerns was prohibited by governmental order as a means of conserving materials and of insuring a uniform distribution of available milk. The American Army supported this policy and ice cream was not supplied except as it was prepared by hand freezing in small quantities in a few messes. The British restriction was removed after the liberation of France and Belgium and in January, 1945, the use of ice cream by U. S. Army units in England and in the continent was authorized and encouraged. It was specified, however, that ice cream would be prepared from ration components exclusively and that civilian manufacturing agencies must maintain U. S. Army standards of sanitation. In August, 1945, ice cream mix became a normal component of the ration issue.

Dehydrated Foods.--The issue of dehydrated foods was not a serious problem in the European Theater because these items never predominated in the ration. Dried milk was acceptable. Dried egg was not received enthusiastically but it was a useful item if used as an ingredient. The wastage was excessive whenever it was served as an omelet or as scrambled egg because of the inability or refusal of cooks to prepare it properly. Onion was very satisfactory if used with ground beef. It was unsatisfactory if used as a vegetable. Potato was acceptable if reconstituted properly. Sweet potato was a good product but the amount in the B ration was excessive for the average soldier. Carrots and beets were reasonably satisfactory. Obviously, none of these dried foodstuffs was a good substitute for the canned product. The problem of dehydrated foods was worsened by the fact that relatively few cooks had received sufficient training on the handling of this type of foodstuff.

Local Procurement of Foodstuffs.--The general policies governing the procurement of foodstuffs from sources within the theater were designed to save transoceanic shipping by the maximum use of local surpluses and, at the same time, to protect the food rationing programs of the British and other allied governments by restrictions on miscellaneous purchases by individuals and units of the American forces. In the case of certain foodstuffs, particularly milk, the factor of medical hazard was also involved. The British Ministries of Food and of Agriculture made available large quantities of such foodstuffs as flour, bread, prepared cereals, rolled oats, tea, marmalade, syrup, condiments, potatoes and vegetables. Procurement through authorized Quartermaster Purchasing Officers was also authorized on the continent but this was limited largely to fresh vegetables and the supply permitted only occasional issue. The supply of potatoes, cabbage, carrots, beets, rutabagas and Brussels sprouts was practically unlimited in England although the quality of stored items became very inferior by spring. Tomatoes and lettuce were only abundant during short seasons so that the dietary was generally lacking in fresh salad components. (Figure 14). Fresh fruits were notably lacking in the American ration. Seasonal apples and pears were unrationed in England and the same was true of apricots and grapes in France but the former were of inferior quality and the latter were readily available only in southern France. Shipments of oranges which were received occasionally in 1944 and 1945 were therefore especially appreciated by the troops.

The purchase of meals in public restaurants was prohibited on the continent. No such restriction prevailed in the United Kingdom although the demand for meals sometimes exceeded the supply. The American Red Cross provided snack bars which were well patronized. These were limited to British sources of supply and to British rationing in the United Kingdom but were allowed to purchase Quartermaster subsistence supplies on the continent. The sale of Quartermaster ration components to individuals, except general officers, was never authorized.

Direct purchase of subsistence from British sources by organizations of the first units arriving in the British Isles was prohibited. In November 1943, type "B" officers' messes were permitted to purchase locally available unrationed foodstuffs but this authorization was soon withdrawn. Type "B" messes continued to operate in the United Kingdom and on the continent, except in the communications zone, and purchased foodstuffs from the Quartermaster exclusively. In June 1945, all messes in the theater became type "A" messes except those

specifically exempted by the Theater Commander.

In common with British practice, American forces cultivated gardens in order to provide an additional supply of fresh vegetables. An agricultural officer was designated in each post, camp and station to supervise the gardening program with the assistance of a British agricultural officer. It was specified that troops would not be used for this project if it interfered with training. Actually, most of the work was performed by British labor and, later, by prisoners of war. Considerable quantities of potatoes, peas, green beans, lettuce, greens, cucumbers, onions and radishes were grown in large and small plots of ground in and adjacent to camps. Many static units continued this program on the continent in the spring of 1945, especially after prisoners of war labor became plentiful.

Rations in Staging Areas.--The most important problem in connection with staging areas was that faced in the "marshalling area" which extended along the southern English coast and from which troops embarked for the invasion of France. Elaborate plans were made for the rapid movement of troops from the camps to the nearby embarkation docks and beaches but less imposing precautions were taken to ensure adequate nutrition in the invasion troops and satisfactory sanitation in the camps. The Chiefs of the Nutrition Branch and of the Subsistence Division were directed to inspect personally messing procedures and to institute corrective measures, if necessary, throughout the area. The majority on the staff of the Division of Preventive Medicine, Office of the Chief Surgeon, as well as nutrition officers, sanitary engineers, and medical officers assigned to Southern Base Section, worked in these camps for weeks before and after D-day.

A special ration provided a particularly choice menu for the invasion troops. The use of leftover foods was rigidly restricted and hashes and milk and bread puddings were omitted from the menus to minimize the possibility of outbreaks of food poisoning. Additional instruction was given mess personnel in all phases of mess operation. The "housekeeping" detachments in the camps had been drawn from many miscellaneous units throughout the United Kingdom and the majority of the mess personnel had been given preliminary but inadequate training in messes of static service units. The maintenance of superior standards was also handicapped by the fact that medical inspectors for the camps were drawn from personnel of general hospitals which had recently arrived in theater and which had the minimum of field experience.



Figure 14

A special shipment of tomatoes from the Canary Islands for issue to troops, May 1945.



1890

1890

The original plan for embarkation of troops was based upon the uninterrupted loading of ships with no provision for hot meals at loading points. Stormy weather interfered with the loading schedule after the movement of troops from marshalling area camps to loading points was underway so that troops were held at loading points 1 to 6 days. The Nutrition Branch successfully opposed the feeding of operational rations during this period and arrangements were immediately completed for the feeding of hot meals. At the Southampton docks a large central kitchen distributed cooked food to various feeding points. At Weymouth, and elsewhere, cooked food was supplied by messes in nearby marshalling area camps. The two systems worked unusually well particularly that at Weymouth. There, the long lines of vehicles on the beach, laden with troops and with equipment and halted long enough for the service of a hot meal before moving on into the LST's, proved an unforgettable sight.

Much that was accomplished in the marshalling areas and all that was done at the loading points was omitted from the original planning. The unfortunate tendency of staff officers to take messing for granted in the planning of staging camps seriously needs correction. Although this phase of planning had been given some consideration in the marshalling area operation the actual provision of kitchen equipment and the prior training of housekeeping personnel were far from satisfactory. The situation on the continent, particularly in the staging area near Le Havre was immeasurably worse. Here, practically no attention had been given to messing until after troops arrived in the area. The Nutrition Branch was never informed of the setting up of this staging area until complaints were received because of the non-existence of messing facilities. The vigorous, combined efforts of the section nutrition officer and of messing teams of the Quartermaster Corps corrected this otherwise impossible situation.

Feeding of Troops on Trains.--The same problem of faulty planning, which interfered with the satisfactory nutrition of troops in staging areas, was found in the original operation of troop trains on the continent. In this case, no provision, other than the issue of C or K rations, was made for the subsistence of troops who would travel on unheated trains for 24 to 48 hours. These plans were made without the information or recommendation of either the Nutrition Branch or the Subsistence Division. Repeated conferences of these two interested groups with representatives of Transportation Corps and of the Ground Force Reinforcement Command were necessary before kitchen cars were added as components of the trains. This was accomplished and a special train ration was issued so that the service of hot meals became possible.

A similar problem was encountered in connection with the feeding of truck drivers on the famous Red Ball Express and on other regular convoy routes. In this case, messes were installed along the highways for the feeding of hot meals, a procedure incomparably superior to the more convenient but less effective reliance upon C or K rations.

Feeding on Hospital Trains.--In contrast to the failure of planning for the feeding of troops in staging areas and on troop trains, adequate provision was made for the nourishment of patients on hospital trains (Figure 15). These trains were used on a small scale in the United Kingdom before D-day. Nearly 50 were in operation on the continent early in 1945. Nutrition officers traveled on the trains at frequent intervals and aided materially in the development of "hot meal" service. In the original plan in the United Kingdom, meals consisted of sandwiches, hot drinks and fruit juices although the Nutrition Branch had urged the service of hot meals. Hot meals were found practicable as the personnel on the trains gained experience and at least one hot meal daily became the rule (Figure 16). A special ration was issued hospital trains and ingredients for between-meal supplements of soup, eggnog and fruit juices were included.



Figure 15

The kitchen car of a hospital train.



Figure 16

The serving of food to litter patients on a hospital train.

THE NUTRITION OF PRISONERS OF WAR, ALLIED NATIONALS, AND OTHERS

Rations for Prisoners of War.

A small number of German and Italian prisoners of war (POW) were brought to the United Kingdom from North Africa in 1943. Prisoners captured in Normandy in 1944 increased the number but the total in the United Kingdom under the control of the U. S. Army was never large. These POW were issued a ration which did not differ greatly from that supplied American troops (Column 1, Table 14). No distinction was made in the rations for working and nonworking prisoners.

POW on the continent were issued a similar ration until 7 December 1944, except that nonworkers received 20% less than workers (Columns 2 and 3, Table 14). At this time the worker's ration was reduced from 3860 to 3258 calories; nonworkers received 10% less (Columns 4 and 5, Table 14). Another reduction was made in April 1945 (Columns 6 and 7, Table 14). For the first time separate rations were authorized nonworkers because it was not feasible to make an overall percentage deduction in the worker's ration to bring the caloric level down to the 2000 calorie level ordered by the Theater Commander for nonworkers. These ration decreases were the result of the disparity between tremendous numbers of captured prisoners and the relatively small stocks of available foodstuffs (Figure 17). Furthermore, the 2000 calorie ration was authorized as the theater ration for displaced persons and others whose subsistence was the responsibility of G-5. The earlier rations supplied nonworkers were in accordance with the Geneva Convention and were in excess of the actual requirements of the prisoners. This original policy was bitterly criticized by allied civilians because nonworking prisoners had more to eat than allied workers. Following the German surrender in May 1945, practically all the prisoners held by the Armies inside of Germany were classified as "disarmed forces" and their subsistence became the responsibility of the civilian food administration. POW in the Communications Zone remained on the POW ration (Figure 18).

The components of POW rations were mostly Quartermaster supplies originally intended for use in the troop ration. The quality, therefore, was good. The method of preparation preferred by the Germans was the concoction of a stew containing nearly all of the ration components. This was fortunate because it was possible to issue dehydrated potatoes and vegetables, which served the purpose admirably and which were less acceptable in the troop ration. Captured enemy flour was used as long as it lasted.

In February and March 1945 the Nutrition Branch was directed to investigate the nutritional status of POW in American custody. The survey team, consisting of 2 medical and 2 nutrition officers examined 800 prisoners in representative work camps and enclosures. The results showed that the nutrition of prisoners who had been in American hands for 50 days or more was satisfactory and considerably superior to that of newly captured Germans. This indicated that the POW ration in use during the early part of 1945 was superior to the ration of the German Army.

In August 1945 the Nutrition Branch was directed to make a second theater survey of the adequacy of the feeding of POW and of German disarmed forces. The 2000 calorie ration was found to be insufficient for German prisoners under 21 years of age and for others who were classed as nonworkers but whose caloric needs were significantly increased by fatigue duties, calisthenics or marching. The 2000 calorie ration was adequate for individuals who were inactive in fact. The German civilian ration issued to disarmed forces varied from 1200 to 1500 calories at that time and was inadequate. This was especially true because there was no opportunity for the men in the enclosures to supplement their rations as German civilians were able to do from gardens, household supplies, etc.

Feeding of Prisoner of War Patients.--German prisoner of war patients were fed the same ration as American patients until July 1945. They were given medical care in U. S. Army hospitals and in hospitals operated by captured German medical officers and enlisted personnel. The question of supplying the hospital ration to the German-staffed hospitals was thoroughly discussed before it was accepted as a sound policy. Later, it was realized that this method of nourishing German prisoner patients could not be controlled insofar as military hospitals within Germany were concerned. The distribution of the regular hospital ration to these units was abused and there was no way to prevent the dissipation of desirable components of the ration throughout the civilian population. This was true because of the lack of sufficient American personnel to supervise closely the many German units involved. As a result, the policy with respect to the feeding of prisoner patients was changed and a special POW hospital supplement was issued to these hospitals in place of the regular troop ration and supplement. Prisoner patients in American hospitals, however, continued to receive the American hospital ration. The POW supplement was composed of meat, egg, milk, sugar, etc., and was a thoroughly desirable and useful addition to the POW ration. Prisoner patients were better nourished than civilian patients or "displaced person" patients.



Figure 17

8000 Nazi prisoners captured by the 8th Infantry Division in the Ruhr pocket near Renscheid, Germany, receive "K" rations, April 1945.



Figure 18

German Prisoners of War in a mess line at Central
Enclosure No. 404, Delta Base Section, May 1945.

It should be realized that conditions made it impossible to adhere to the usual interpretation of the Geneva Convention as it is applied to the subsistence of prisoners of war. The Office of the Chief Surgeon based its action on the policy that all prisoners must be fed sufficient food to permit preservation or attainment of good health. In accordance with this policy, a maintenance ration was supplied nonworkers. Workers were allowed additional food in proportion to the energy demand of the work performed. Patients were given a supplement which permitted sound nutritional therapy. The feeding system was investigated repeatedly in order to be certain that prisoners were treated humanely and decently.

Rations for Allied Nationals and Others.--The Nutrition Branch was not directly concerned with civilian feeding in Europe inasmuch as this problem was assigned to the Public Health Branch of SHAEF. Prior to the organization of that Branch, the Nutrition Branch had participated in early plans for this phase of the Army's general task on the continent. It continued to cooperate with the Public Health officers and assisted the latter in preliminary surveys in Germany. Nutrition officers were transferred to these survey teams, which were later directed by the Public Health Branch, G-5, as rapidly as the needs of the Army permitted.

Contrary to earlier expectations, the nutritional status of the civilian populations of France, Belgium and Luxemburg at the time of the invasion was surprisingly good. Scarcity of food existed in the large cities but not in rural areas. The situation in the cities was far from extreme and there was no interference with the tactical operations of the Army on this account.

The Army used civilian labor wherever possible. Rations were supplied to this group in order to make certain of their nutritional fitness. They were supplied 1 to 3 meals daily depending upon whether they worked in areas adjacent to their homes or elsewhere. In addition to this Continental Civilian Employee's Ration, the Quartermaster was authorized to issue rations to the following groups: Italian service units; Russian nationals; liberated manpower units; and, certain units attached to the French Army. These rations were regularly reviewed by the Nutrition Branch. They were patterned after the American Army ration, except that account was taken of racial food habits, and they supplied 3000 to 3200 calories.

Enemy Civilians.--Investigations of the nutritional status of German civilians were made as quickly as possible after occupation by American forces in order to ascertain whether lack of food was a public health problem which might immediately affect the welfare of the Army. These surveys which included examinations of displaced

persons and recovered prisoners of war as well as of German civilians, demonstrated the urgency of the RAMP problem and the advisability of using German civilian food stocks in the feeding of displaced persons. Generally, enemy civilians were well supplied with food, especially in smaller communities and rural areas. Certainly there was no justification for the wholly inadequate rationing of allied prisoners held in the German stalags. Even in the industrial Ruhr there was no noticeable impairment of civilian nutrition. Here, however, it was evident that food stocks were low and that a future shortage was likely, particularly if it was expected that the area would resume some phases of its former industrial activity. The complete picture of German civilian nutrition will be found in the records of the Nutrition Branch of G-5.

Table 1

NUTRITION OFFICERS IN ETOUSA

Name and Rank	Serial Number	Date of Arrival	Principal Assignments
*Barrick, Elliot R. Maj. (then Capt), Sn.C.	O-438413	27 May 1943	Hq. ETOUSA Advance Section
Bell, Thomas A. 1st Lt., Sn.C.	O-374116	12 Feb. 1944	Southern Base Section 15th Hospital Center
Black, Alex Capt., Sn.C.	O-488968	12 Feb. 1944	Southern Base Section United Kingdom Base, Hq. TSFET
Bratton, Robert W. Capt. (then 1st Lt. Sn.C.	O-493225	20 Oct. 1943	Eighth Air Force 12th Hospital Center Channel Base Section
Braun, Winfred Q. Capt., Sn.C.	O-473079	23 July 1944	Oise Intermediate Section
Butts, Joseph S. Major, Sn.C.	O-228840	1 Sept. 1942	Eighth Air Force
Carroll, William R. Capt., Sn.C.	O-479107	20 June 1944	Ninth Army
**Chambers, William H. Lt. Col. (then Maj.) Sn.C.	O-442246	18 Jan. 1943	Hq. ETOUSA United Kingdom Base 12th Army Group
*Combs, Gerald F. Maj. (then Capt.) Sn.C.	O-408734	27 May 1943	Hq. ETOUSA Southern Base Section
Crookshank, Herman F. Capt., Sn.C.	O-475952	20 Oct. 1943	North Ireland Base Section, Normandy Base Section, 807th Hospital Center

Table 1 (cont'd)

Name and Rank	Serial Number	Date of Arrival	Principal Assignments
Davis, Horace J. Maj. (then Capt.), Sn.C.	O-492381	14 Dec. 1943	Southern Base Section G-5 (SHAEF)
Gardner, Karl E. Capt. (then 1st Lt.), Sn.C.	O-517410	11 Feb. 1944	Western Base Section Channel Base Section Third Army
***Griffith, Wendell H. Col. (then Lt.Col.), Sn.C.	O-426073	31 Aug. 1942	Chief, Nutrition Branch, ETOUSA
Henderson, LaVell M. Capt., Sn.C.	O-376471	26 May 1943	Medical Field Service School
Johnson, Clyde S. Capt., Sn.C.	O-448377	2 May 1945	Oise Intermediate Section
*Jones, Joseph L. Capt., Sn.C.	O-474315	23 July 1944	Hq. Command, Com Z Normandy Base Section
Lambooy, John P. Capt., Sn.C.	O-474692	20 Mar. 1944	Ninth Air Force
Light, Amos E. Capt. (then 1st Lt.), Sn.C.	O-503733	14 Dec. 1943	Western Base Section 802nd Hospital Center
McVicar, Robert W. Capt. (then 1st Lt.) Sn.C.	O-385331	26 May 1943	Eastern Base Section Brittany Base Section Assembly Area Command
*Nasset, Edmond S. Lt.Col. (then Maj.) Sn.C.	O-427889	1 June 1943	Ninth Air Force
Rouse, Warren W. 1st Lt., Sn.C.	O-516386	8 May 1945	Seine Section
*Schaefer, Arnold E. Maj. (then 1st Lt.) Sn.C.	O-375737	27 May 1943	Western Base Section Channel Base Section

Table 1 (cont'd)

Name and Rank	Serial Number	Date of Arrival	Principal Assignments
Stock, Carl G. Capt.(then 1st Lt.) Sn.C.	O-517478	2 July 1944	Western Base Section 803rd Hospital Center
Sullivan, Royal A. Capt.(then 1st Lt.) Sn.C.	O-518547	23 July 1944	3rd Reinf. Depot
Supplee, William C. Maj.(then Capt.)Sn.C.	O-467137	2 July 1944	Western Base Section 805th Hospital Center
*Tuckey, Stewart L. Maj.(then Capt.), Sn.C.	O-496837	14 Dec. 1943	Central Base Section Seine Base Section 814th Hospital Center
*Weswig, Paul H. Maj.(then 1st Lt.) Sn.C.	O-447368	5 Sept. 1942	Eighth Air Force USSTAF
*White, Julius Maj.(then Capt.) Sn.C.	O-506727	12 Dec. 1943	16th Reinf. Depot
Wilcke, Harold L. Maj.(then Capt.) Sn.C.	O-244972	23 July 1944	Seine Section

* Awarded Bronze Star.

** Awarded Bronze Star with Oak Leaf Cluster.

*** Awarded Legion of Merit and Bronze Star.

Officers assigned initially to G-5, SHAEF, or to the European Civil Affairs Division are not included. The following officers were assigned to the Nutrition Branch for short periods in connection with nutritional surveys:

Major Howard J. Agaston, M.C.
Capt. Raphael Greenstein, M.C.
Capt. Leonard Horn, M.C.
Capt. Herman C. Weinberg, M.C.

In addition, Dean S. Fleming, then 1st Lt., M.C., supervised nutrition activities in the Office of the Chief Surgeon from 4 to 31 Aug. 1942; and, Herbert Pollack, then Lt. Col., M.C., Chief of Medical Service, 15th General Hospital, was assigned to the Nutrition Branch on continued temporary duty starting 1 Jan. 1945.

Officers were on duty in the medical sections of the headquarters of commands listed in table. Actual assignments were in most cases in units under the control of the respective headquarters.

Table 2

DISTRIBUTION OF NUTRITION OFFICERS IN ETOUSA ^a

Assignment ^b	1 Jan. 1943	1 July 1943	1 Jan. 1944	1 July 1944	1 Jan. 1945	1 July 1945	1 Jan. 1946
ETOUSA, U.K. and Con.	1	3	3	2	2	2	1
Eighth Air Force, U.K.	1	1	1	1	-	-	-
Eighth A.F. Composite Command, U.K.	1	1	-	-	-	-	-
Eighth A.F. Fighter Command, U.K.	-	-	1	1	1	-	-
Ninth Air Force, U.K. and Con.	-	-	1	1	1	-	-
Ninth A.F. Bomber Command, U.K. and Con.	-	-	-	1	1	1	-
U.S. Strategic Air Force, Con.	-	-	-	-	1	1	-
Third Army, U.K. and Con.	-	-	-	-	-	1	1
Ninth Army, U.K. and Con.	-	-	-	1	1	1	-
Assembly Area Command, Con.	-	-	-	-	-	1	-
3rd Reinf. Depot, GFRC, Con.	-	-	-	-	1	1	1
16th Reinf. Depot, GFRC, U.K. and Con.	-	-	1	1	1	1	-
Medical Field Service School, U.K. and Con.	-	1	1	1	1	1	-
Central Base Section, U.K.	-	-	1	1	1	-	-
Eastern Base Section, U.K.	-	1	1	1	-	-	-
North Ireland Base Section, U.K.	-	-	1	1	-	-	-
Southern Base Section, U.K.	-	1	2	4	-	-	-
Western Base Section, U.K.	-	1	2	5	-	-	-
United Kingdom Base, U.K.	-	-	-	-	1	1	-
Advance Section, Con.	-	-	-	1	1	1	-
Brittany Base Section, Con.	-	-	-	1	1	-	-
Channel Base Section, Con.	-	-	-	-	2	2	-
Normandy Base Section, Con.	-	-	-	1	-	1	-
Oise Intermediate Section, Con.	-	-	-	-	1	2	1
Seine Section, Con.	-	-	-	-	2	1	-
12th Hospital Center, U.K.	-	-	-	-	1	-	-
15th Hospital Center, U.K.	-	-	-	-	1	1	-
802nd Hospital Center, U.K.	-	-	-	-	-	1	-
803rd Hospital Center, U.K.	-	-	-	-	1	-	-
805th Hospital Center, U.K.	-	-	-	-	1	-	-
807th Hospital Center, Con.	-	-	-	-	-	1	-

Table 2 (cont'd)

Assignment	1 Jan. 1943	1 July 1943	1 Jan. 1944	1 July 1944	1 Jan. 1945	1 July 1945	1 Jan. 1946
812th Hospital Center, Con.	-	-	-	-	1	-	-
814th Hospital Center, Con.	-	-	-	-	1	1	-
Total in United Kingdom	3	9	15	21	7	3	0
Total in Continent	0	0 ^c	0	2 ^d	18 ^e	19 ^f	4
Total in Theater	3	9 ^c	15	23 ^d	25 ^e	22 ^f	4

^a Officers assigned to G-5, SHAEF, or to EGAD are not included.

^b Officers were on duty in the medical sections of the headquarters listed in the table although actual assignments were, in many instances, in units under the control of the respective headquarters.

^c One officer subsequently reassigned in the United States.

^d One officer subsequently transferred to European Civil Affairs Division.

^e Four officers subsequently transferred to European Civil Affairs Division and one to U.S. Group Control Council.

^f Four officers subsequently transferred to European Civil Affairs Division, 13 reassigned or discharged in the United States and one deceased.

Table 3

TROOP RATION SCALES IN ETOUSA
(Ounces per man per day)

COMPONENT	1 British Home Service Ration 1942	2 British American Ration 1942	3 Cir. #8 Hq. USAFBI 16 February 1942	4 Cir. #13 Hq. ETOUSA 11 February 1943
Beef, as boneless	3.21	5.31	7.43	4.90
Pork and Ham, as boneless	0.64	1.06	2.97	2.25
Chicken, fresh, und.	-	-	2.00	-
Lamb, car.	0.92	1.51	-	0.70
Fish, cd.	0.43	0.43	-	0.35
Bacon	1.43	3.00	2.00	1.00
"Other Meat" Group	1.71	1.71	-	2.95
Eggs, as dehyd.	-	0.07	0.50	0.60
Cheese	0.57	0.57	0.25	0.50
Milk, as evap.	3.75	4.00	5.00	7.00
Butter or Margarine	1.50	2.00	2.00	1.50
"Other Fat" Group	-	0.28	1.28	0.85
Sugar, gran.	2.00	3.00	5.00	4.00
Fruit Spreads	1.00	1.00	0.50	0.50
"Other Sugar" Group	-	0.64	0.50	0.80
Bread	10.00	10.00	8.00	6.00
Flour	2.00	2.50	4.00	3.00
"Other Grain" Group	1.86	2.43	2.35	2.00
Dried Legumes	0.57	0.57	0.50	1.25
Peanut Butter	-	-	-	0.25
Potatoes	13.00	10.00	10.00	10.00
Vegetables, LG and Y, fresh	3.00	8.00	-	-
Vegetables, cd.	-	-	5.00	6.50
Tomato Group, fresh	1.00	1.00	-	-
Tomato Group, cd.	-	-	2.00	3.00
Citrus Fruits, cd.	-	-	-	2.42
Lemon Crystals	-	-	-	0.08
Vegetables, Other, fresh	1.71	5.00	2.00	-
Vegetables, Other, cd.	-	-	2.00	4.00
Fruits, Other, cd.	-	-	3.90	5.00
Fruits, Other, dried	0.86	2.00	0.30	0.70
Cocoa	0.19	0.19	0.30	0.30
Coffee	-	1.75	2.00	1.10

Table 3 (cont'd)

COMPONENT	1 British Home Service Ration 1942	2 British American Ration 1942	3 Cir. #8 Hq. USAFBI 16 February 1942	4 Cir. #13 Hq. ETOUSA 11 February 1943
Tea	0.29	0.14	0.05	0.10
Baking Powder and Soda	-	0.08	0.09	0.20
Bouillon Cubes	-	-	-	0.04
Flavoring Extracts, fluid	-	0.02	0.02	0.03
Pickles, asstd.	-	0.14	0.16	0.50
Salt	0.38	0.50	0.50	0.50
Sauces	-	0.18	-	0.06
Other Condiments	-	0.15	0.05	0.07
Vinegar	-	0.11	0.16	0.40
Yeast	-	0.02	-	-
Cash Allowance	2-1/2d	-	-	-
Total Weight in lbs.	3.20	4.35	4.55	4.71

1. Carcass beef and pork are expressed as boneless meat according to the ratio 1:0.743.
2. Margarine (1.5 ounces) was a component of the British Home Service and British-American rations only.
3. The cash allowance of 2-1/2 pence, approximately 4 cents (US), is used for the purchase of miscellaneous foodstuffs and is estimated by the British War Office to supply 214 additional calories.

Table 4

NUTRITIVE VALUE OF TROOP RATIONS IN THE UNITED KINGDOM,
WITH AND WITHOUT CORRECTION FOR MINIMUM LOSSES DURING
ISSUE, STORAGE, PREPARATION, AND SERVICE OF FOOD

Nutrients		1 British Home Service Ration 1942	2 British American Ration 1942	3 U.S.Ration Aug.-Oct. 1942	4 U.S.Ration Nov.-Dec. 1942	5 U.S.Ration Jan.1943 Jan.1945
Energy	Cal.	3060 (2776)	4182 (3704)	4766 (4170)	4465 (3940)	4049 (3624)
Protein	Gm.	96 (91)	124 (118)	149 (142)	136 (129)	130 (123)
Fat	Gm.	117 (97)	197 (156)	215 (164)	205 (161)	165 (132)
Carbohydrate	Gm.	406 (385)	478 (457)	557 (532)	519 (494)	536 (486)
Calcium	Gm.	0.63 (0.60)	0.77 (0.73)	0.88 (0.84)	0.87 (0.82)	0.96 (0.91)
Iron	Mg.	19 (18)	25 (24)	29 (28)	28 (27)	27 (25)
Vitamin A (animal)	I.U.	3050 (2890)	1233 (1170)	1503 (1428)	2474 (2350)	2448 (2330)
Carotene (plant)	I.U.	4647 (4415)	9695 (9200)	9638 (9156)	9842 (9350)	11482 (10910)
Thiamine	Mg.	1.98 (1.50)	2.69 (1.99)	3.01 (2.18)	3.05 (2.13)	2.61 (1.88)
Riboflavin	Mg.	1.83 (1.58)	1.97 (1.71)	2.43 (2.11)	2.42 (2.08)	2.40 (2.07)
Niacin	Mg.	20 (16)	24 (19)	32 (26)	28 (22)	27 (21)

Table 4 (cont'd)

Nutrients		1 British Home Service Ration 1942	2 British American Ration 1942	3 U.S.Ration Aug.-Oct. 1942	4 U.S.Ration Nov.-Dec. 1942	5 U.S.Ration Jan.1943 Jan.1945
Ascorbic Acid	Mg.	100 (45)	147 (69)	134 (104)	164 (97)	167 (96)

Uncorrected and corrected values represent "as issued" and "as consumed" values respectively. Corrected, or "as consumed" values, are estimated by making the following deductions from "as issued" values:

- a. Deduction of 5% to cover wastage loss during issue, storage, preparation, and service of ration components.
- b. Deduction of 25% of meat and cooking fat which is assumed to be uneaten.
- c. Deduction of nutrient losses listed in Table 5.

The corrected value in the table is the value in parenthesis.

The composition of this ration is shown in Column 1, Table 7. Analysis is based on Tables of Food Composition, U.S.D.A. Miscellaneous Bulletin, No. 572, (1945).

This value was calculated according to the procedure used in estimating caloric values of U.S. Army rations. The British War Office estimates the average value of the monetary allowance as 214 calories, thus increasing the total ration value to 3274. The energy content of the ration was increased 284 calories in May 1943 and an additional allowance of 200 calories was authorized troops undergoing hard training.

Table 5

LOSS OF NUTRIENTS OF FOODSTUFFS DURING COOKING

Food Group	Loss in percent			
	Thiamin	Riboflavin	Niacin	Ascorbic Acid
Meat	35	20	25	0
Eggs	25	10	0	0
Cereals	10	0	10	0
Legumes	20	0	0	0
Vegetables, L.G.Y.	40	25	25	60
Tomatoes	5	5	5	15
Vegetables, Other	25	15	25	60
Potatoes	40	25	25	60

Recommendations of the National Research Council, 7 June 1945.

Table 6

ALLOWANCES OF NUTRIENTS (AS CONSUMED)
RECOMMENDED BY NATIONAL RESEARCH COUNCIL

Nutrients		Prior to 19 April 1945		After 19 April 1945	
		1	2	3	4
Energy	Cal.	3000	3750	3000	3750
Protein	Gm.	70	70	70	70
Fat	Gm.	-	-	-	-
Carbohydrate	Gm.	-	-	-	-
Calcium	Gm.	0.80	0.80	0.80	0.80
Iron	Mg.	12	12	12	12
Vitamin "A"	I.U.	2000	2000	2000	2000
Carotene	I.U.	3000	3000	3000	3000
Thiamin	Mg.	1.80	2.05	1.50	1.73
Riboflavin	Mg.	2.70	3.00	2.00	2.30
Niacin	Mg.	18	21	15	17
Ascorbic Acid	Mg.	75	75	75	75

The National Research Council recommended level of 5000 I.U. of total vitamin A is listed in the table as 2000 I.U. of vitamin A (animal sources) and 3000 I.U. of carotene (plant sources).

Table 7

COMPOSITION OF RATIONS PRESCRIBED BY AUTHORIZED TROOP MENUS IN
ETOUSA
(Pounds per 100 men for 10 days)

Component	1 UK, 1 Jan. 1943 to 31 Jan. 1945	2 Con. July 1944	3 Con. 1 Aug. to 30 Sept. 1944	4 Con. 1 Oct. 1944 to 31 Jan. 1945	5 Theater, 1 Feb. 1945 to 31 Oct. 1945
Bacon	61	95	85	75	52
Beef, boneless	264	-	93	157	246
Pork, boneless, and Ham	162	-	64	105	109
Fowl, undrawn	64	-	-	74	92
Lamb, carcass	13	-	-	-	17
Fish, canned	28	48	36	34	21
Meat-Vegetable Group	46	265	165	107	26
Other Meat Group	148	412	343	256	207
Eggs, as dehyd.	36	37	39	40	40
Cheese	29	34	34	33	32
Milk, as evap.	438	347	347	393	475
Butter, fresh	80	-	20	34	50
Butter, canned	-	46	35	34	19
Other Fat Group	45	32	32	36	44
Sugar, gran.	248	259	259	279	257
Fruit Spreads	69	136	136	56	80
Other Sugar Group	41	35	35	58	18
Bread	424	198	300	450	465
Biscuits	17	170	110	10	-
Flour	149	130	130	152	137
Other Grain Group	94	111	111	108	118
Dried Legumes	41	72	72	48	56
Peanut Butter	17	20	20	23	25
Potatoes, fresh	711	-	180	353	313
dehyd.	-	47	47	48	49
LQ and & Vegetables, fresh	279	-	-	88	105
canned	195	238	238	185	210
dehyd.	8	15	15	6	3
Tomato Group, fresh	29	-	-	9	3
canned	189	235	235	171	217
Citrus Fruits, canned	119	133	133	146	164
Lemon Crystals	4	9	9	4	4

Table 7 (cont'd)

Component	1 UK, 1 Jan. 1943 to 31 Jan. 1945	2 Con. July 1944	3 Con. 1 Aug. to 30 Sept. 1944	4 Con. 1 Oct. 1944 to 31 Jan. 1945	5 Theater, 1 Feb. 1945 to 31 Oct. 1945
Other Vegetables,					
fresh	134	-	-	111	82
canned	109	125	125	115	119
dehyd.	3	5	5	2	2
Other Fruits,					
fresh	41	-	-	33	-
canned	284	358	358	255	300
dehyd.	4	5	5	3	4
dried	48	43	43	39	29
Cocoa	14	9	9	10	12
Coffee	72	80	80	79	88
Tea	5	1	1	7	5
Baking powder and soda	7	9	9	14	9
Bouillon cubes	0.9	2.4	2.4	1.8	1.0
Flavoring extract, fluid	0.8	-	-	0.5	0.3
Tablets	-	0.2	0.2	0.1	0.1
Pickles, assorted	31	16	16	15	26
Salt	27	20	20	41	36
Sauces	2.0	0.3	0.3	0.3	1.6
Other Condiments	2.70	3.25	3.25	5.71	2.70
Vinegar	11	6	6	14	9
Yeast, dry	1.0	-	-	0.3	1.0

Canned corned beef hash, meat and vegetable hash, and meat and vegetable stew.

Frankfurters, cold cuts and canned sausage, chili, luncheon meat, chicken, turkey, corned beef, roast beef, beef and gravy, pork and gravy, and ham.

Lard substitute and salad oil.

Apple butter, marmalade, assorted jams and jellies.

Dessert powders, syrup and candy.

UK-prepared from British 85% extraction flour. Continent-prepared from U.S. enriched white flour.

Table 7 (cont'd)

Breakfast cereals, cornmeal, cornstarch, hominy grits, macaroni, spaghetti and rice.

Beans, white or kidney, lima beans, baked beans (calculated as dry bean), and dehydrated bean and pea soup.

String beans, broccoli, cabbage, carrots, greens, lettuce, peas and brussels sprouts.

Green asparagus, string beans, carrots, peas, pumpkin, sweet potatoes, and spinach.

Cabbage, carrots and sweet potatoes.

Tomatoes, tomato juice, catsup and puree.

Grapefruit, grapefruit juice, orange juice and blends.

Fortified with ascorbic acid, 3980 mg. per lb.

Beets, cauliflower, celery, corn, cucumbers, leeks, marrow, green onions, dry onions, parsnips, radishes, rutabagas and turnips.

Green lima beans, beets, corn and sauerkraut.

Beets and onions.

Apples, apricots, pears and grapes.

Apples, applesauce, apricots, berries, cherries, figs, fruit cocktail, grape juice, peaches, pears, pineapple and pineapple juice.

Apple and cranberry.

Apple, apricot, peaches, prunes and raisins.

Lemon and vanilla.

Lemon, vanilla and maple.

Celery salt, cinnamon, cloves, ginger, dry mustard, nutmeg, pepper and poultry seasoning.

Table 8

HOSPITAL (PATIENTS') RATION SCALES IN ETOUSA
(ounces per patient per daily)

Component	1 Cir. #13 Hq. ETOUSA 11 February 1943	2 Adm. Cir. #85 SOS, ETOUSA 21 November 1943	3 Cir. #63 ETOUSA 5 June 1944	4 Cir. #81 ETOUSA 15 June 1945
Beef, as boneless	4.20	5.00	5.00	5.90
Pork and Ham, as boneless	1.50	2.00	2.00	2.00
Chicken, fresh, und.	1.50	2.75	2.75	3.85
Lamb, car.	0.70	-	-	-
Fish, cd.	0.70	0.70	0.70	0.35
Bacon	1.00	1.00	1.00	1.00
"Other Meat" Group	1.10	0.70	0.70	0.70
Eggs, as dehyd.	0.70	0.75	0.75	0.75
Cheese	0.30	0.40	0.40	0.40
Milk, as evap.	10.00	12.00	12.00	12.00
Milk, malted, pwd.	0.02	0.10	0.10	0.10
Butter	1.50	1.50	1.50	1.50
"Other Fat" Group	0.75	0.65	0.65	0.75
Sugar, gran.	4.00	4.00	4.00	4.50
Fruit Spreads	1.00	1.00	1.00	1.00
"Other Sugar" Group	1.30	0.80	0.80	0.80
Bread	4.00	4.50	7.50	7.00
Flour	2.00	1.50	1.50	2.00
"Other Grain" Group	2.00	1.50	1.50	1.50
Dried Legumes	0.50	0.30	0.30	0.50
Peanut Butter	0.25	0.20	0.20	0.30
Potatoes	4.00	6.00	9.00	9.00
Vegetables, LG and Y, cd.	6.00	6.00	6.00	6.00
Tomatoes, cd.	4.00	4.00	4.50	4.44
Citrus Fruits, cd.	2.44	3.12	3.12	4.00
Orange Crystals	0.22	0.22	0.22	-
Lemon Crystals	0.04	0.06	0.06	0.06
Onions, dry	1.00	1.00	1.00	1.00
Vegetables, Other, cd.	3.00	3.00	3.00	2.50

Table 8 (cont'd)

Component	1	2	3	4
	Cir. #13 Hq. ETOUSA 11 February 1943	Adm. Cir. #85 SOS, ETOUSA 21 November 1943	Cir. #63 ETOUSA 5 June 1944	Cir. #81 ETOUSA 15 June 1945
Fruits, Other, cd.	7.00	7.00	7.00	7.00
Fruits, Other, dried	0.60	0.60	0.60	0.60
Cocoa	0.30	0.30	0.30	0.30
Coffee, R and G	1.10	1.28	1.28	1.44
Tea	0.10	0.10	0.10	0.08
Baking Powder and Soda	0.20	0.20	0.20	0.25
Bouillon Cubes	0.04	0.04	0.04	0.04
Flavoring Extracts	0.03	0.03	0.03	0.03
Pickles, asstd.	0.50	0.50	0.50	0.50
Salt	0.50	0.50	0.50	0.50
Sauces	0.06	0.06	0.06	0.06
Soups, cd.	1.60	1.60	1.60	1.60
Other Condiments	0.07	0.07	0.07	0.05
Vinegar	0.40	0.40	0.40	0.40

Table 9

COMPOSITION OF RATIONS PRESCRIBED BY AUTHORIZED HOSPITAL
(PATIENTS') MENUS IN ETOUSA
(Pounds per 100 Patients for 10 Days)

Component	1 U.K. 1 Mar.1943 to 31 Aug.1944	2 U.K. 1 Sept.1944 to 31 Oct.1945	3 Con. July 1944	4 Con. 1 Oct.1944 to 30 Sept.1944	5 Con. 1 Oct.1944 to 28 Feb.1945	6 Con. 1 March 1945 to 31 Oct. 1945
Bacon	65	53	95	85	71	49
Beef, boneless	305	310	-	93	188	256
Pork, boneless and Ham	150	218	-	64	130	108
Fowl, und.	84	197	-	-	102	96
Lamb, car.	-	-	-	-	-	18
Fish, cd.	40	39	67	55	51	41
Meat-Vegetable Group	-	-	265	207	86	21
Other Meat Group	95	100	557	488	342	294
Eggs, as dehyd.	43	46	45	47	41	50
Cheese	26	8	34	34	34	33
Milk, as evap.	663	686	674	674	713	748
Milk, skim, pwd.	5	7	-	-	-	9
Milk Products, pwd.	13	5	1	1	2	7
Butter, fresh	92	90	-	20	45	52
Butter, cd.	-	-	96	85	68	38
Other Fat Group	40	45	41	41	46	48
Sugar, gran.	246	254	259	259	275	268
Fruit Spreads	99	84	143	143	69	116
Other Sugar Group	58	63	53	53	71	67
Bread	286	482	198	300	460	518
Biscuits	7	-	170	110	8	-
Flour	106	151	130	130	155	137
Other Grain Group	109	94	138	138	129	144
Dried Legumes	31	32	141	141	100	56
Peanut Butter	11	21	26	26	28	26
Potatoes, fresh	386	700	-	180	427	304
Potatoes, dehyd.	-	-	77	77	62	39
Vegetables, LG & Y, fresh	175	137	-	-	101	102
cd.	242	259	290	290	257	293
dehyd.	5	-	29	29	16	3

Table 9 (cont'd)

	1	2	3	4	5	6
	U.K. 1	U.K. 1		Con. 1	Con. 1	Con. 1
	Mar.1943	Sept.1944	Con.	Oct.1944	Oct.1944	March 1945
	to 31	to 31	July	to 30	to 28	to 31
	Aug.1944	Oct.1945	1944	Sept.1944	Feb.1945	Oct.1945
Tomato Group,						
fresh	21	-	-	-	7	4
cd.	199	246	304	304	243	276
dehyd.	2	-	-	-	-	2
Citrus Fruits,						
cd.	244	300	186	186	301	267
Lemon Crystals	4.9	2.5	9.4	9.4	2.4	4.1
Other Vegetables,						
fresh	131	138	-	-	109	77
cd.	129	150	128	128	126	153
dehyd.	3	2	5	5	2	2
Other Fruits,						
fresh	38	-	-	-	26	-
cd.	433	457	365	365	308	457
dehyd.	9	4	5	5	3	4
dried	34	36	57	57	50	30
Cocoa	13	18	19	19	20	16
Coffee, R and G	71	83	95	95	92	89
Soluble	2	2	-	-	1	2
Tea	5	4	2	2	7	4
Baking Powder and						
Soda	4.5	7.0	9.0	9.0	12.7	8.9
Bouillon Cubes	2.1	2.1	2.4	2.4	1.8	1.1
Flavoring Extracts,						
fluid	1.07	0.19	-	-	0.40	0.33
Tablets	-	0.09	0.20	0.20	0.10	0.42
Pickles, asstd.	35	15	16	16	15	24
Salt	29	21	20	20	37	37
Sauces	2.4	0.7	0.3	0.3	0.4	1.8
Other Condiments	3.60	1.36	2.03	2.25	4.62	3.03
Vinegar	13	2	6	6	13	10
Yeast, dry	0.7	0.2	-	-	0.4	1.0
Multivitamin						
Capsules	0.17	0.26	0.27	0.27	0.27	0.38
Soup, asstd.,cd.	49	67	21	21	31	69

Table 9 (cont'd)

footnotes

Individual components include those listed in footnote, Table 7, and the following special hospital supplements: tuna, cd.; ovaltine, cocomalt, and malted milk powder; brown and confectioner's sugar, gelatin dessert powder, and glucose syrup; egg noodles; purees of string beans, beets, carrot, peas, and spinach; assorted soups, cd.; and, multivitamin tablets.

Table 10

NUTRITIVE VALUE OF HOSPITAL (PATIENTS') RATIONS (TYPES A AND B)
IN ETOUSA, WITH AND WITHOUT CORRECTION FOR MINIMUM LOSSES DURING
ISSUE, STORAGE, PREPARATION, AND SERVICE OF FOOD.

Nutrients		1 Type A UK March 1943 to Aug.1944	2 Type A UK Sept.1944 to Oct. 1945	3 Type B Con. July 1944	4 Modified Type A Con.Aug.- Sept.1944	5 Modified Type A Con.Oct. 1944 to Jan.1945	6 Type A Con.Feb.- Oct.1945
Energy	Cal.	4063 (3647)	4615 (4139)	4795 (4317)	4854 (4369)	5007 (4511)	4813 (4337)
Protein	Gm.	130 (123)	152 (144)	168 (159)	170 (161)	178 (169)	168 (159)
Fat	Gm.	176 (143)	191 (154)	191 (156)	197 (160)	207 (170)	189 (153)
Carbohydrates	Gm.	490 (467)	572 (544)	599 (569)	600 (571)	608 (576)	608 (582)
Calcium	Gm.	1.28 (1.22)	1.24 (1.18)	1.75 (1.66)	1.50 (1.42)	1.54 (1.46)	1.46 (1.39)
Iron	Mg.	23 (22)	28 (26)	35 (33)	34 (33)	34 (32)	33 (30)
Vitamin A (animal)	I.U.	3285 (3121)	3113 (3007)	2619 (2488)	3365 (3157)	3635 (3454)	3713 (3526)
Carotene (plant)	I.U.	10108 (9603)	10728 (10192)	11769 (11181)	10973 (10425)	11785 (11196)	9890 (9395)
Thiamine	Mg.	2.37 (1.75)	3.02 (2.22)	2.23 (1.75)	2.58 (2.00)	3.13 (2.41)	3.00 (2.34)
Riboflavin	Mg.	2.84 (2.52)	3.13 (2.76)	3.36 (2.99)	3.45 (3.07)	3.77 (3.36)	3.78 (3.35)

Table 10 (cont'd)

		1 Type A UK March 1943 to Aug.1944	2 Type A UK Sept.1944 to Oct. 1945	3 Type B Con July 1944	4 Modified Type A Con.Aug.- Sept.1944	5 Modified Type A Con.Oct. 1944 to Jan.1945	6 Type A Con.Feb.- Oct.1945
Niacin	Mg.	28 (22)	35 (28)	31 (25)	33 (26)	38 (30)	37 (29)
Ascorbic Acid	Mg.	162 (113)	179 (120)	138 (105)	135 (105)	146 (96)	159 (116)

Uncorrected and corrected values represent "as issued" and "as consumed" values respectively. Corrected, or "as consumed" values, are estimated by making the following deductions from "as issued" values:

- a. Deduction of 5% to cover wastage loss during issue, storage, preparation, and service of ration components.
- b. Deduction of 25% of meat and cooking fat which is assumed to be uneaten.
- c. Deduction of nutrient losses listed in Table 5.

The corrected value in the table is the value in parenthesis.

Composition of rations in Columns 1-6 above, is shown in Columns 1-6, Table 9. Analysis of rations is based on Tables of Food Composition, U.S.D.A., Miscellaneous Bulletin, No. 572 (1945). The multivitamin tablets in the hospital ration are not included in the analyses.

Table 11

ISSUE OF OPERATIONAL RATIONS
(Per cent of rations issued)

Period	A or B Rations	C	Operational Rations		Total
			K	10-in-1	
<u>1944</u>					
June	0	14	15	71	100
July	57	6	9	28	43
August	52	14	14	20	48
September	58	18	10	14	42
October	79	7	5	9	21
November	88	3	5	4	12
December	87	3	5	5	13
<u>1945</u>					
January	91	2	3	4	9
February	91	2	4	3	9
March	88	4	5	3	12
April	74	8	7	11	26
May	87	2	4	7	13
June	94	1	3	2	6
July	96	1	2	1	4

Data supplied by Office of the Chief Quartermaster, Hq. ETOUSA.

Table 12

NUTRITIVE VALUE OF OPERATIONAL RATIONS SUPPLIED ON

THE CONTINENT IN 1944
(as issued)

		1 "D"	2 "C"	3 "K"	4 "10-in-1"	5 "B"
Energy	Cal.	1770	2775	2786	3927	3915
Protein	Gm.	32	121	89	124	122
Fat	Gm.	95	78	129	171	141
Carbohydrate	Gm.	200	379	317	473	532
Calcium	Gm.	0.70	0.82	1.28	1.31	1.00
Iron	Mg.	11	33	14	22	27
Vitamin A	I.U.	0	18370	4674	5220	9430
Thiamine	Mg.	1.50	1.00	2.10	2.30	1.98
Riboflavin	Mg.	0.50	1.80	2.40	2.70	2.42
Niacin	Mg.	1	28	15	24	27
Ascorbic acid	Mg.	0	87	65	80	103

Data from TB Med. 141, W.D., Feb. 1945.

Approximately 60 mg. in the form of fortified "lemon crystals".

Approximately 37 mg. in the form of fortified "lemon crystals".

Table 13

NUTRITIVE VALUE OF TROOP RATIONS (TYPES A AND B) ON THE
CONTINENT, WITH AND WITHOUT CORRECTION FOR MINIMUM LOSSES
DURING ISSUE, STORAGE, PREPARATION, AND SERVICE OF FOOD.

Nutrients		1 Type B July 1944	2 Modified Type A Aug.- Sept. 1944	3 Modified Type A Oct.1944- Jan. 1945	4 Type A. Feb.-Oct. 1945
Energy	Cal.	3893 (3493)	3952 (3545)	4105 (3687)	3979 (3571)
Protein	Gm.	127 (120)	129 (122)	137 (130)	136 (129)
Fat	Gm.	147 (117)	152 (121)	162 (131)	156 (125)
Carbohydrate	Gm.	516 (490)	517 (492)	525 (497)	506 (483)
Calcium	Gm.	1.24 (1.18)	0.99 (0.94)	1.03 (0.98)	1.01 (0.96)
Iron	Mg.	28 (27)	28 (27)	28 (26)	28 (26)
Vitamin A (animal)	I.U.	1292 (1227)	2038 (1936)	2308 (2193)	2805 (2664)
Carotene (plant)	I.U.	9221 (8760)	8425 (8004)	9237 (8775)	8276 (7862)
Thiamine	Mg.	1.78 (1.41)	2.13 (1.66)	2.68 (2.07)	2.63 (2.03)
Riboflavin	Mg.	2.41 (2.13)	2.50 (2.21)	2.82 (2.50)	2.89 (2.55)

Table 13 (cont'd)

Nutrients		1 Type B July 1944	2 Modified Type A Aug.- Sept. 1944	3 Modified Type A Oct.1944- Jan.1945	4 Type A. Feb.-Oct. 1945
Niacin	Mg.	25 (20)	26 (21)	31 (25)	32 (25)
Ascorbic acid	Mg.	112 (87)	110 (87)	121 (78)	121 (82)

Uncorrected and corrected values represent "as issued" and "as consumed" values respectively. Corrected, or "as consumed" values, are estimated by making the following deductions from "as issued" values:

- a. Deduction of 5% to cover wastage loss during issue, storage, preparation, and service of ration components.
- b. Deduction of 25% of meat and cooking fat which is assumed to be uneaten.
- c. Deduction of nutrient losses listed in Table 5.

The corrected value in the table is the value in parenthesis.

Composition of rations in Columns 1-4 is shown in Columns 2-5, Table 7. Analysis is based on Tables of Food Composition, U.S.D.A. Miscellaneous Bulletin, No. 575 (1945).

Table 14

NUTRITIVE VALUE OF PRISONER OF WAR RATIONS
(as issued)

Nutrients		1	2	3	4	5	6	7
		UK until	Continent		Theater			Theater
		7 Dec.	Until 7 Dec.		7 Dec. 1944			16 Apr. 1945
		1944	1944		to 16 Apr. 1945			to 31 Oct. 1945
		Workers		Non-		Non-		Non-
		and Non-		Workers	Workers	workers	Workers	workers
		Workers	Workers	Workers	Workers	workers	Workers	workers
Energy	Cal.	3612	3860	3089	3258	2632	2955	2038
Protein	Gm.	119	120	96	108	97	106	80
Fat	Gm.	126	141	113	75	67	45	26
Carbo- hydrate	Gm.	500	528	422	538	410	532	371
Calcium	Gm.	0.81	0.90	0.72	0.63	0.57	0.72	0.59
Iron	Mg.	27	30	24	25	23	28	20
Vitamin A (animal)	I.U.	1481	1208	966	376	338	543	318
Carotene (plant)	I.U.	7975	14190	11784	7843	7057	7950	7359
Thiamine	Mg.	2.13	1.79	1.43	1.66	1.49	2.31	1.66
Riboflavin	Mg.	1.97	2.00	1.60	1.55	1.40	1.95	1.50
Niacin	Mg.	23	22	18	23	20	20	15
Ascorbic acid	Mg.	132	99	79	162	145	82	73

FIGURES

1. Tankmen of the 94th Infantry Division eat hot food, brought by truck, while awaiting assignment to battle near Nennig, Germany, January 1945.
2. The new field ration "A" of the European Theater of Operations, England, February 1943.
3. An enlisted men's mess of an Ordnance Company, England, January 1943.
4. The kitchen of the 298th General Hospital, Bristol, England, January 1944.
5. A Ranger Battalion cook "5 in 1" ration during a field ration trial in Southern England, July 1943.
6. A field bakery in Belgium, 3026th Quartermaster Bakery Company, November 1944.
7. Loading refrigerator trucks with frozen meat for distribution to combat troops, Advance Section, Communications Zone, Homecourt, France, November 1944.
8. An abandoned German stable serves as a kitchen for members of the 36th Infantry Division in Alsace Lorraine, December 1945.
9. A wireman of the 57th Signal Battalion heats "C" rations for his crew, Hochfelden area, France, January 1945.
10. A kitchen under canvas feeds 1200 patients of the 167th General Hospital, Tournlaville, France, January 1945.
11. American prisoners of war liberated by the Third Army in Fuchsmuehl, Germany, after a thirty-five mile forced march from Bad Orb, labor in a salt mine and a starvation diet, April 1945.
12. Americans in their prisoner of war quarters after liberation by the Third Army, Germany, May 1945.
13. American soldiers captured during the "Battle of the Bulge" receive medical care following liberation from the prison hospital, Fuchsmuehl, Germany, April 1945.

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14. A special shipment of tomatoes from the Canary Islands for issue to troops, May 1945.
15. The kitchen car of a hospital train.
16. The serving of food to litter patients on a hospital train.
17. 8000 Nazi prisoners captured by the 8th Infantry Division in the Ruhr pocket near Renscheid, Germany, receive "K" rations, April 1945.
18. German Prisoners of War in a mess line at Central Enclosure No. 404, Delta Base Section, May 1945.

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2. Distribution of nutrition officers in ETOUSA.
3. Troop ration scales in ETOUSA.
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9. Composition of rations prescribed by authorized hospital (patients') menus in ETOUSA.
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12. Nutritive value of operational rations supplied on the Continent in 1944.
13. Nutritive value of troop rations (type A and B) on the Continent, with and without correction for minimum losses during issue, storage, preparation and service of food.
14. Nutritive value of prisoner of war rations.

A HISTORY OF PREVENTIVE MEDICINE
IN THE
EUROPEAN THEATER OF OPERATIONS
UNITED STATES ARMY
1941 - 1945

PART V - Venereal Disease Control

by

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PART V

Venereal Disease Control

A Branch for Venereal Disease Control was created in the Division of Preventive Medicine of the Office of the Chief Surgeon of the European Theater of Operations on 25 September 1942. Prior to that time, general over-all supervision of the venereal disease program, including both treatment and preventive activities, had been under the direction of the Division of Professional Services of the same office. Beginning 25 September 1942, supervision of preventive and control activities passed to the newly created Venereal Disease Control Branch of the Division of Preventive Medicine, while supervision of treatment was retained by the Professional Services Division throughout the life of the Theater. The present discussion is limited to aspects of prevention and control of the venereal diseases.

At the time the Branch for Venereal Disease Control was formed, a full time venereal disease control officer was attached to the Office of the Surgeon of the Western Base Section which then contained the majority of the service troops. Among the Ground Forces Units which were then present, the 1st Infantry Division, the 34th Infantry Division, the 1st Armored Division, and the Headquarters, II Corps, had full or part time venereal disease control officers who functioned for their organizations, and to some extent in liaison with civilian communities.

The Eighth Air Force Composite Command had a full time venereal disease control officer who was energetically pursuing a well-rounded program including efforts to develop cooperation with the civilian authorities in Northern Ireland. None of these officers were in a position, however, to develop a comprehensive program embracing all of the necessary control activities.

At the outset of the operation of the Branch for venereal disease control, a protocol was drawn up to reduce to a working classification the responsibilities of the Branch, and the activities to which it should devote major attention. These activities were classified into the following categories:

1. The development and coordination of educational programs for men, officers, and medical officers.
2. Plans for and the supervision of provision of proper prophylactic facilities and materials, both mechanical and chemical.

3. Epidemiologic studies to determine the extent and location of venereal disease problems, with particular reference to causes of high venereal disease rates and the remediable factors.
4. Initiation and maintenance of cooperative relationships with other military and civilian agencies seeking the same objectives.
5. Consultation with command regarding policies and administrative procedures relating to venereal disease control.
6. Consultation on methods of diagnosis and treatment for those who become infected.

In the period of the existence of the Branch as such, from the time of its original formation until the dissolution of ETOUSA, it was never found necessary materially to alter the original protocol for content. As situations developed and circumstances changed, marked alterations in the distribution of emphasis were found to be necessary, and these perhaps constitute the most significant experiences to be related.

These changing circumstances were of infinite variety and constant occurrence, but for the purpose of this narrative may be divided into six phases:

1. The early problems in the United Kingdom, when the military situation was that of creating a base of operations.
2. The later situation in the United Kingdom when, with the establishment of bases well along, major problems were created by the tremendous concentration of United States troops in the already overcrowded British Isles.
3. The phase of planning for and mounting the invasion of the continent.
4. The continental phase from the beachheads to Paris.
5. The continental phase from Paris to the Rhine.
6. The continental phase after the investiture of Germany

The narrative will be constructed, therefore, on the plan of discussing, in so far as it is applicable, each of the items of the original operating protocol as it was developed in the successive phases.

The Early Problems in the United Kingdom.--From the very beginning there was a serious need for educational materials which was finally resolved only long after this phase of the operation was over. An adequate number of copies of the Training Film 8-154, "Sex Hygiene" was made available in the autumn of 1942, but the majority of the men had seen this film so many times during their training period that it had lost much of its effectiveness. On 15 May 1943, a request was transmitted for duplicate negatives of the films being displayed in the United States by the American Social Hygiene Association. Copies were made and widely displayed, and since the films were fresh material they were well received in spite of the fact that their appeal was directed much more towards the civilian than a military population.

Lacking supplies from the United States, posters and other types of visual aids were developed locally. This resulted in material which was sometimes excessively crude, was usually badly reproduced since almost all of it was done on the standard mimeograph, and rarely contained a new appeal. These disadvantages were offset to some extent by the development of poster contests with prizes, usually in the form of special privileges. Where this idea was enthusiastically carried out, the publicity attendant upon the contest was frequently of more value than the resulting posters.

Both because of the circumstances and because it was the considered opinion of those responsible that it constituted the most fruitful method, the educational program depended to a large extent upon word of mouth in informal discussions. In promoting this idea, the full time venereal disease control officers devoted their attention to discussions with medical officers and with commanding officers of the higher echelons. Fig. 1. In the discussion with the medical officer, however, it was emphasized that a large part of his responsibility was to see to the proper education of the junior officers of the command to which he was attached, who in turn would be charged with the education of their noncommissioned officers and men. Early in 1943, the suggestion was being made that the education of the rank and file of soldiers be made the responsibility primarily of the noncommissioned officers.

Courses of instruction in venereal disease control for officers were included in the officer's instruction courses.

Provision of proper prophylactic facilities.---Up until the end of 1942, all of the condoms available, save those which forehanded commanders had brought with their unit supply, were being procured from British sources of manufacture. These articles were totally unsatisfactory for two important reasons. In the first place, they were too small, and secondly, they were made with a deep constriction about three centimeters back from the closed end, and the effect being to give them a freely hanging tip to which our soldiers objected strenuously. They were, however, of good quality latex and withstood inflation tests without difficulty. By the end of 1942, condoms of American manufacture meeting standard specifications were available for purchase in the post exchanges, but free issue was not to come until later.

Up to the end of 1942, there were no supplies of the pocket chemical prophylactic kit available but early in 1943 a small supply of V-Packettes was received. In order to utilize these to the greatest advantage, they were earmarked for issue solely to organizations of the VIII Air Force. Almost immediately there began to appear isolated reports to the effect that the silver picrate jelly in the V-Packette was painful to the urethral mucosa and therefore the men were tempted to avoid its use. Alternatively there were reports that the jelly was so irritating as to produce a nonspecific urethritis. These reports, however, were isolated and in general the kit was well received and used as extensively as available supplies would allow.

During this phase of the operations there was very little use made of station prophylaxis. This was in sharp contrast, both to what had been seen in the training camps in the United States and what was later observed on the Continent of Europe. There were a number of reasons for this which probably must be taken in summation in order to afford an adequate explanation for the observed phenomenon. There was, of course, a prophylactic station as an integral part of every regular medical department installation. It is a matter of common experience that these prophylactic facilities are not as extensively patronized as ad hoc prophylactic stations set up in convenient locations outside of military installations. In the United Kingdom the small use of the prophylactic facilities in medical department installations continued, but there was a general and equally small use made of the ad hoc installations as well. A number of reasons for this was readily apparent.



Figure 1

Physicians consider the problem of venereal disease control, Medical Field Service School, England, 1943.

In the first place, it was difficult, sometimes to the point of impossibility, to secure from the British adequate quarters in which to house a prophylactic station. There was a critical shortage of housing; all requisitions for space had to be approved by the British Ministry of Works; and in the face of the enormous demands which were being placed upon them by the influx of American troops, they were unwilling to release for use as a prophylactic station quarters which were suitable for any other purpose. In the second place, where stations were established, it was impossible to mark them in a manner to make them easy to find. British sensibilities forbade the display of prominent signs and the rigid requirements of the total blackout forbade the use of the conventional green light. Perhaps the most important reason for the small use of station prophylaxis, arose from the fact that the vast majority of the sexual exposures were wholly uncommercial and on a friendly basis. Surveys among soldiers revealed that under these circumstances they were much less impressed with the desirability or necessity of prophylaxis after exposure.

Epidemiologic studies.--The original epidemiologic studies were conducted on two lines. The first related to investigation of the circumstances prevailing within organizations reporting exceptional venereal disease rates. In these surveys, units with rates conspicuously lower than the average for comparable organizations were studied, as well as those whose rates were higher. From the former group many valuable ideas were gained which were passed along for utilization where applicable. The latter were studied with particular reference to the educational status of the troops, the facilities for prophylaxis, the existence of recreational facilities, and the type of control exercised by command over the environment.

The second type of epidemiologic work was based on the use of ETOUSA MD Form 302. This was developed prior to WD MD Form 140 and was so applicable to the particular problems encountered that it was continued in use throughout the life of the theater. Long before it was possible to make use of the contact information contained on these forms they were subjected to periodic analysis by the Medical Records Division to determine the distribution of places of exposure. With this information, studies were made of the conditions obtaining in the civilian communities which were reported as sources of venereal infection out of proportion to their population or the number of troops stationed in the vicinity. Where possible, factual information of this type was used for discussion with local civilian authorities.

✓ The initiation and maintenance of cooperative relationships with other agencies.—During this first phase, excellent cooperative relationships were established with the appropriate officers of the British Army, the Canadian Army, the Royal Air Force, the American Navy and the British Ministry of Health. The closest contact and most cordial relationships were maintained with all of these agencies throughout, but save for the Ministry of Health, more than an exchange of amenities was seldom required. Respects were also paid to the appropriate medical officers of the Royal Navy.

The excellent cooperative relationships which were enjoyed with the Ministry of Health began under exceedingly happy auspices. The Chief of the Division of Preventive Medicine had since 1940 been in intimate association with the British Ministry of Health, first as a civilian expert on loan from Harvard University and later as the head of the American Red Cross-Harvard University Field Hospital Unit. Through him introductions to all of the proper people were readily arranged and the Chief Medical Officer of the Ministry of Health, Sir Wilson Jameson, proved from the outset to be interested in the venereal disease problems and was most helpful. His blessing assured easy access to local medical officers of health, who, each in his own area, was virtually autonomous. The cordial relationships established with those local medical officers of health during this first phase were of incalculable value in facilitating the development of the scheme of contact investigation which came a little later.

It was readily obvious that not only would it be fruitless to attempt to establish working arrangements with the civilian police authorities but more importantly that such efforts might be misunderstood by the British as reflecting desire on our part to meddle in affairs which they considered strictly their own, and so might occasion resentment. The fruitlessness of such an attempt arose out of the fact that the British consider sex behavior as entirely a personal matter not subject to legislation or regulation. Fig 2. Public opinion frowns upon brothels and so very few were known to exist, and outside of London itself, there was relatively little commercialized prostitution. Whether professional or amateur, however, so long as the woman ostensibly was acting as a free agent, and so long as a procurer or facilitator was not readily apparent, there were no laws in the British Isles to govern her behavior providing she conducted herself in such a manner as to avoid other breach of the peace, except for one London Statute of 1828, which forbids obstruction of free passage in a public way. This is interpreted by the Metropolitan police as involving the laying on



Figure 2

London means Picadilly.
A

of hands, so that if a professional prostitute on the streets of London actually attempts to manhandle her prospective customer, she may be had up in Bow Street and fined forty shillings.

Only two other civilian agencies need be mentioned at this time; the British Social Hygiene Council and the Central Committee for Health Education. The former was essentially the analog of the American Social Hygiene Association while the latter was made up of chosen members of the former with the direct although somewhat behind-the-scene sponsorship of the Ministry of Health. It acted as a medium for the dissemination of health information with (although not so stated) especial emphasis on the venereal diseases. Cordial and cooperative relationships with both of these agencies were established from the outset and the Chief of the Branch for Venereal Disease Control sat from time to time on committees of these organizations. Since their objectives were largely the development of a long range program for the British population, little if any of their activities had immediate bearing on the problems of the United States Army.

Consultation with command.---From the outset it was determined as a matter of policy that the Branch for Venereal Disease Control of the Division of Preventive Medicine of the Office of the Chief Surgeon would insofar as practicable limit its consultations with command to the performance of staff function; courtesy calls on commanding officers when visiting posts; and consultation on specific questions when requested. It was thought much more desirable to deal in general with the senior medical officer in an organization or a camp, post, or station; make to him both general and specific recommendations relating not only to his activities but also concerning recommendations which he might make to command and then to leave to him the responsibility for developing local plans in keeping with general policy but with a view to local problems. It was the consensus of all concerned that this latter made for better relationships between the surgeon and his commanding officer; had the advantage of avoiding the natural resistance which sometimes develops toward gratuitous suggestions from outside; and facilitated the development of more workable venereal disease control programs.

In the performance of the staff function, an unvarying policy was adopted to keep command directives concerning venereal disease control at the absolute minimum. It was felt best to rely on a few simple directives containing clear statement of basic principles and then to allow each organization to work out the details in the manner most suitable for its problems and personnel, assisting them from the central office when specific problems arose.

Consultations on methods of diagnosis and treatment.---The closest and most cordial relationship existed between the Branch for Venereal Disease Control of the Division of Preventive Medicine and the Branches of the Professional Service Division which were charged with treatment. There was constant informal interchange of information and suggestions and no important steps were taken by either without consultation with the other. The Chief of the Branch for Venereal Disease Control, however, had no formal association with the care of patients.

The Later Situation in the United Kingdom.---With the developments which followed as a natural consequence of the increasing troop strength, a number of important changes were made in the organization and administration of the venereal disease control program.

In the earlier phase the entire program was administered directly from the Office of the Chief Surgeon. During the second phase which roughly began in the Spring of 1943 with the creation within the various echelons of Surgeon's offices of competent staffs in Preventive Medicine, the administration of the routine activities in venereal disease control was transferred largely to the responsibility of the respective base sections for the Communications Zone troops; to the Surgeon of the Eighth Air Force (later to become USTAFF Surgeon when portions of the Ninth Air Force began to arrive for the Air Force); and to the Headquarters of Corps and Armies as they arrived.

The Branch for Venereal Disease Control thus became in large measure an agency for collecting and disseminating information, for coordination of the activities of the various echelons which were actually operating the venereal disease control program, and the medium through which suggestions on general policy and procedure could be channelled to command. In one important particular, however, which will be brought out below in the discussion of contact investigation, the Branch retained active operational direction of what at this time was a pioneer project in the British Isles.

The Development of Coordination of Educational Programs.---Early in 1943, a study was made of the educational status of troops arriving in the European Theater of Operations from the continental United States. Information was sought of the adequacy of the information of the soldier concerning the general nature of venereal diseases, the method of their transmission, and the available methods for their prevention. The result of this survey indicated the necessity for intensification of the educational program in the European Theater, and afforded the suggestion which was transmitted informally that there

be intensification of the educational program for the troops during their training period in the United States.

Through an informal arrangement with the Surgeon of the Central Base Section the venereal disease control officer for that base section was placed in over-all charge of the educational program. He procured the services of a professional artist, who upon designs and suggestions which had been previously approved by a board appointed for the purpose, created a series of educational posters which compared favorably with those acquired two years latter from the United States. At the same time the Central Base Section was made the testing ground for various types of educational approach and so far as the European Theater of Operation is concerned it was here first demonstrated that the venereal disease noncommissioned officer trained to lead informal small discussion groups was a powerful factor in venereal disease education.

During this period all of the base section venereal disease control officers carried on extensive educational programs working largely through the medium of the unit medical officer, and were made personally responsible for wide display of the available films which included the then shopworn TF 8-154 and the American Social Hygiene Association films "In Defense of the Nation," "With These Weapons," "Health is a Victory," and "Plain Facts." Fig. 3.

The Branch in the office of the Chief Surgeon prepared and sponsored for publication in the theater newspaper, the Stars and Stripes, a series of educational and informational articles on the venereal diseases and members of the staff of the Branch lectured periodically to medical officers at the Medical Field Service School.

Provisions of prophylactic facilities and materials.--The relatively small use of station prophylaxis continued during this period but even with only a small percentage of the troops who were being exposed seeking it, the troop strength was increasing so rapidly and there were so many venereal exposures that the available ad hoc stations came in for enough patronage to justify their existence. Relentless pressure from our side had by this time served somewhat to wear down the British objection to giving us space so that in the larger population centers it was possible to provide decent premises of reasonably convenient location. Also local arrangements in many instances had gained the approval of the blackout warden for the use of a shaded and much subdued but at the same time visible green light as a marker at night. The most important advance in this direction was made through an agreement with the American Red Cross whereby the Army was given space for the operation of prophylactic stations on

the premises of Red Cross Clubs. This arrangement was ideal since men on pass or furlough were virtually required to stay in Red Cross hostels because of the shortage of housing facilities among the civilian population, and so found a prophylactic station right in their path when they returned to quarters after a sexual exposure.

Another important advance was made in the facilitation of widespread use of prophylactic materials by the War Department authorization for free issue of condoms and chemical prophylactic kits. In developing the mechanism of this free issue it was found impracticable to have the actual distribution done by the Medical Department. This was because of the fact that in both of the larger groups of troops, the Service Forces and Air Forces, it was not uncommon for men to be quartered at considerable distances from the Medical Department installations from which they received medical care. Under these circumstances the soldier would seldom be near the dispensary unless reporting for sick call and the medical department had no personnel to devote to the task of supervising a general distribution of prophylactic materials in barracks and day-rooms. Accordingly, the Medical Department continued procurement of prophylactic materials, but by arrangement, the Quartermaster accepted responsibility for storage and issue. Up until the continental invasion, storage and issue was with Class I supplies; on the continent it was found more practicable to store and issue with Class II and IV supplies. This arrangement was subject to a certain amount of criticism from outside the theater but for those who saw it function it seemed a simple and practicable solution to a minor supply problem.

In May 1943, there was instituted a trial of sulfathiazole by mouth for the prophylaxis of gonorrhea and chancroid. The results of the first three months trial in three organizations with appropriate controls were so encouraging that recommendations were made for use of the method according to the principles laid down in Circular Letter No. 146, Office of The Surgeon General, 12 August 1943.

Epidemiologic studies.---Both routine and special epidemiologic studies were carried out in much the same manner as originally planned, with particular effort to focus attention and direct effort toward organizations with unusually high venereal disease rates and communities which were reported as providing more than their proportionate share of venereal infections. A special type of epidemiologic study is described in the following section under the heading "Contact Investigation."

Fig. 4.



Figure 3

The British public house, colloquially "pub", was the soldier's club as well as that of the common man of Britain.



Figure 4

The GI finds Britain to his liking.

Cooperation with other military and civilian agencies.—In April 1943, under the auspices of the British Home Office there was held a meeting which was attended by a large number of the higher dignitaries of the British Government and by representatives of the American and Canadian Armies. After an extensive discussion of the problems caused by the venereal diseases, both to the services and to the British civilian population, it was agreed to form a committee to be known as the Joint Committee on the Venereal Diseases, which by its articles of reference was charged with making recommendations both to the services and to the British Government with regard to future policies and procedures in venereal disease control. Nothing happened until under continuing pressure from the American side the committee finally had a first meeting in June 1943. The Chairman was Sir Weldon Dalrymple-Champneys, Bart., of the Ministry of Health, and the members were as follows:

Brigadier T. E. Osmond, RAMC	War Office
Air Commodore T. McGlurkin, RAF	Air Ministry
Lt. Colonel M. H. Brown, RCAMC	Canadian Army
Colonel John E. Gordon, MC	United States Army
Mr. T. Lindsay	Ministry of Health
Mr. T. Mathew	Home Office
Chief Constable E. A. Cole	Metropolitan Police
Dr. M. M. Goodman	Department of Health for Scotland
Mr. E. A. Hogan	Department of Health for Scotland
Mr. J. S. Munro	Scottish Home Department
Surgeon Commander D. Duncan, RN (later nominated)	Admiralty
Mr. H. R. Hartwell, Secretary	Ministry of Health

Eight meetings of this committee were held from 25 June until 24 September 1943, and at the last meeting there was brought in a series of sixteen recommendations. The first eight of these dealt with specific recommendations for the development and extension of an educational program; nine through fourteen, inclusive, recommended in detail a program for contact tracing; and the last two concerned the desirability and feasibility of routine serologic testing of certain classes of patients, especially pregnant women. Up until that time the committee had given considerable promise of accomplishment but at the last meeting it bogged down on a discussion of prostitution and was never revived.

The cooperative relationships with the other military and civilian agencies previously named were continued.

During July and August 1943, Dr. Joseph Earle Moore, representing the Sub-committee on Venereal Diseases of the National Research Council, of which he was Chairman, and upon invitation from the British Ministry of Health and the Theater Surgeon made an extensive tour of the British Isles with particular reference to the interrelationships between the military and civilian venereal disease problems. This visit was the subject of two reports; one was confidential to the Theater Surgeon with copies to the Secretary of War and The Surgeon General; the other which was more widely circulated was to the National Research Council.

At the time of arrival of the first United States soldiers in the British Isles, the only venereal disease control measure practiced among the civilian population was the attempt to provide conveniently located free treatment facilities. Discrete little advertisements announcing the location of these treatment facilities were posted in public latrines, but there was no other educational program. There was no reporting of the venereal diseases either by clinics or private physicians and at that time under the provisions of the 1916 Venereal Disease Act, the privacy and secrecy guaranteed the patient were such that it constituted libel even to imply that an individual might have a venereal disease. This, of course, rendered any type of epidemiologic work and contact tracing impossible because no infected person could afford to risk an action for libel by giving the name of one with whom he had sexual contact and who therefore might have a venereal disease.

In the autumn of 1942, however, under pressure from the Ministry of Health for an amplification of the existing methods of venereal disease control, the Privy Council drew up and eventually approved a regulation under the Defense of the Realm Act, known as Defense Regulation 33B, which became operative in December 1942.

Under the provisions of this regulation, a patient with a venereal disease was given an opportunity to name if he chose, after having been warned that there were severe penalties for false information, the individual he would identify as "the source of infection." This information was transmitted by the physician receiving it to the local medical officer of health of the place of residence of the named individual. The medical officer of health, if he were satisfied that the information was valid and given in good faith, held it for file, and if he received a second notification on the same individual, was empowered by the provisions of the regulation to serve upon this "source of infection" certain legal documents requiring the individual to submit to examination and treatment if necessary.

Numerous other legal documents were involved in making final disposition of the case, but from our standpoint the important thing was that here for the first time was a mechanism whereby an individual with a venereal disease could legally give the name of sexual contacts, even though legally he did have to contend that one particular individual was the "source of infection."

A review of the records showed that insofar as information given by United States soldiers was concerned there would be very few actions taken under the strict provisions of Regulation 33B, because it was relatively unusual for one woman to be named twice with sufficient identifying particulars to make operative the legal provisions of the regulation. As has been frequently experienced elsewhere, many promiscuous women were named by more than one soldier, but more commonly than not, only by partial name or partial address, whereas under the letter of the regulation complete names and address were required before action could be taken. It was therefore apparent that we could expect little from the operation of the letter of the regulation by the British authorities.

This being the case, authority was gained from the Chief Surgeon to utilize a staff of Army nurses as "contact investigators" and with the concurrence of Sir Wilson Jameson, Chief Medical Officer of the Ministry of Health, the medical officers of health of six counties in East Anglia were approached to gain their concurrence in the operation of the scheme.

Briefly, the scheme was that the nurse would interview the soldier with a venereal disease, gain from him as much information as could be done by skillful and tactful questioning regarding the identity of his venereal contacts and then attempt to identify these women. If identification could be accomplished, the women were tactfully approached with the suggestion that the medical findings on a friend who was an American soldier, suggested that the woman herself might be in need of medical examination which could be obtained from a private physician or at a designated clinic.

In the beginning, there were many who were dubious that the scheme could be made to work, primarily because of fear that the women would take offense at being approached at all on so delicate a matter and particularly at being approached by an American Army nurse, who for reasons of Theater policy was required to remain in uniform. Only one of the original group of medical officers of health approached, however, refused to give support to the proposal and this individual capitulated soon after the scheme began successful operation in neighboring counties.

Fortunately the fears were entirely unfounded. Of the first group of nearly five hundred women approached, only one took offense and there seemed reasonably good evidence to indicate that she was a professional prostitute. A few of the others (4 percent of the total) took no offense, but nevertheless did not accept the suggestion to submit to examination. More than 76 percent of those identified reported to a clinic or private physician as suggested. The efficiency which the previously existing system had exhibited in controlling the venereal diseases was brought out by the fact that of the entire group only 15 percent had applied for medical care prior to the visit from the United States Army nurse. The remaining 5 percent were found in jails or other institutions.

The success which attended the operation of this scheme made a great impression on the British and as a matter of fact, induced them in many areas to attempt something of the sort on their own initiative. The happy effect which this had on Anglo-American relationships was more than offset during this same period by recurring reports which reached the British concerning the number of soldiers with venereal disease who were disembarking in their ports to mix with and infect their people. This had been duly reported but it continued to such an extent that it finally became a diplomatic issue and occasioned on the 24th of February 1944, a letter from Mr. Winant to General Marshall.

Consultation with command.--Efforts to have published a 1943 version of General Pershing's famous General Order No. 77, which clearly defines the responsibility of the unit commander in venereal disease control, resulted in the publication on 31 December 1943, of a letter addressed to each unit commander from General Jacob L. Devers then commanding. This contained the following passages:... "Contraction of venereal disease is considered evidence of improper indoctrination of the individual which is an indication of poor leadership on the part of the unit commander...The responsibility for proper schooling in preventive measures lies with the unit commander; it is inalienable from command. It is essential that

commanding officers devote their personal attention to the control of venereal disease...The percentage of physically fit soldiers in a command is strong evidence of the efficiency of the commanding officer."

Consultation on methods of diagnosis and treatment.---The close cooperation originally established between the Professional Service Division and Section of Venereal Disease Control in matters which related to the professional care of patients with venereal disease was maintained.

The Phase of Planning and Mounting the Continental Invasion.---During the phase of planning and mounting the invasion of the Continent, the activities concerning the venereal disease control program within the United Kingdom were largely turned over to the Base Sections for operational management, most of the ground work having been accomplished by this time. With the great increase in the troop strength, and the crowding which it inevitably produced, the problems of liaison with the British civilian authorities became increasingly important and were accordingly given a large portion of the effort of the Branch for Venereal Disease Control.

The development and coordination of educational programs for men, officers, and medical officers.---The Branch continued routinely to contribute material for stories in the Stars and Stripes and its weekly feature magazine, War Week. On 27 April 1944 there was published material designed for the basis of an informal talk between company grade officers and their men in the marshalling areas just prior to invasion and this was later made the basis of stories in the Stars and Stripes, War Week, and Army Talks. Otherwise, aside from continuing to participate in the teaching activities of the Medical Field Service School, virtually all of the remainder of the educational activities were operated by the Base Sections, Armies and Air Force.

Provision of prophylactic facilities.---By the Spring of 1944, there was an adequate distribution of prophylactic stations all over the British Isles, the majority of the extra-cantonment installations being in the Red Cross Hostels. These were never widely patronized but they were used enough to justify their existence.

By this time, also, the supply of condoms had been stabilized to the point of allowing an issue at the rate of six per man per month and provide also for sale in the Post Exchanges for those who cared to purchase. The rate of sale tended to fluctuate slightly but commonly averaged about 1.7 per man per month. The supply of chemical prophylactic kits was still irregular and since these items were shipped with a low priority the supply position remained totally unpredictable. Late in 1943, the VIII Air Force had conducted some clinical trials of a one tube prophylactic kit which had been prepared for them in England according to a formula of sulfathiazole, 15 percent, calomel, 33 percent, and lanette wax base to make 10 grams. The clinical trials conducted with the small numbers of this item available occasioned request to The Surgeon General's Office for a supply of a similar item in a more suitable base which at the time was under clinical trial in the United

States. This request was granted and the item was placed on procurement but unfortunately it was given the same number as the old tube item so that it is impossible to determine when it first reached the Theater.

Epidemiologic studies.---The general epidemiologic studies continued and it was found that certain of these, particularly the consolidated analysis of "place of exposure," could be more easily done in the central office and handled as a unit rather than be handled by the individual Base Sections, so this was one activity which was not delegated. For the same reasons the central branch continued to do special epidemiologic studies where these were indicated.

Cooperation with other agencies.---During this period the number of troops in the United Kingdom was so great that it was deemed necessary and desirable to extend the scope of the contact investigation program until finally eight nurses were engaged in this activity. They worked, however, under the direction of Base Sections, although maintaining the closest liaison with the central office. During this same period, at the suggestion of the Ministry of Health, numerous local medical officers of health, influenced to some extent, no doubt, by the fact that the skies had not fallen when we started contact investigation, had organized teams of their own, working on an informal basis and without waiting for a second notification as required by the letter of the Regulation 33B. These activities were of great assistance to our nurses in facilitating their work and the success of the entire scheme is reflected in the low venereal disease rate which was attained in the Theater over this period.

The other cooperative activities were continued without significant change.

Consultation with command.---As a part of the routine job of mounting the Continental operation, the directives regarding the prevention and control of the venereal diseases were gathered together and clarified for the benefit of the Forward Echelon and the Advance Section of the Communications Zone. While this was being done, it became apparent that it would be desirable to gather material covered in several directives into one compact directive, and also to reinforce certain points of existing regulations. Accordingly, there was published on 2 May 1944, Circular Letter No. 49, Headquarters, ETOUSA, which covered all of the command aspects of the prevention and control of the venereal diseases. It is to be noted that in the fifteen months of the existence of the Theater after the publication of this directive it was not found necessary to amend or alter it.

In anticipation of problems which would be encountered on the Continent, this directive contained the following paragraph: "The practice of prostitution is contrary to the best principles of public health and harmful to the health, morale, and efficiency of troops. No member of this command will, directly or indirectly,

condone prostitution, aid in or condone the establishment or maintenance of brothels, bordellos, or similar establishments, or in any way supervise prostitutes in the practice of their profession or examine them for the purposes of licensure or certification. Every member of this command will use all available measures to repress prostitution in areas in which troops of the command are quartered or through which they may pass.

A broader and more general order was published by Supreme Headquarters, Allied Expeditionary Force on 24 May 1944.

Consultation on methods of diagnosis and treatment.---Disturbed by the increasing frequency of the diagnosis of nonspecific urethritis and fearing that this was being used as a subterfuge to evade making a diagnosis of gonorrhea, on 10 March 1944, there was published a directive on the diagnosis and reporting of the venereal diseases which set down criteria permitting a clinical diagnosis of gonorrhea and purposely made any other diagnosis in the case of acute urethritis so difficult as to discourage evasive diagnoses unless there was good clinical or epidemiologic evidence upon which to base doubt of a diagnosis of gonorrhea. It was recognized that this would lead to an occasional erroneous diagnosis of gonorrhea but with the removal of penalties for the venereal diseases, it was felt that the injustice occasioned by this error would be more than offset by the better management of the patient.

The Continental Phase from the Beachheads to Paris.---With the invasion of the continent the complexity of the venereal disease control problem was greatly increased. For many months after D-Day the operation of bases, the provision of facilities for hospitalization, the staging of troops and the operations of the VIII Air Force called for such a troop concentration in the United Kingdom that the extent of the venereal disease problems there remained essentially unchanged. Shortly after the transfer of the Headquarters of the European Theater of Operations to the continent and with the formation of the United Kingdom Base the Branch for Venereal Disease Control of the Division of Preventive Medicine of the Office of the Chief Surgeon transferred the responsibility for the program in the United Kingdom to the Branch for Venereal Disease Control of the Division of Preventive Medicine of the Office of the Surgeon, United Kingdom Base, which continued the operations with few modifications of the original protocol.

The main activities in venereal disease control from this time on lay in the development of a program which was suitable to the differing conditions which were encountered on the continent. As was noted above, it was not found necessary at this time to make major alterations in the protocol under which venereal disease control was set up and operated in the United Kingdom, but the marked differences in the problems encountered necessitated a revision of the distribution of emphasis.

In the United Kingdom conditions were such that the major emphasis of the extra-cantonment venereal disease control program was properly and most fruitfully directed toward contact investigation and to closely allied epidemiologic methods. There, also, with the virtual absence of openly organized prostitution, and with British law and custom respecting with such diligence the rights and privileges of the individual, no attack on the venereal diseases through repression of prostitution was possible. On the continent quite a different situation prevailed. Fig. 5.

Prostitution was recognized and accepted as a part of the social structure; in contrast, epidemiologic studies were not so fruitful as previously. It was obvious, therefore, that a determined program for the repression of prostitution was the method best calculated to minimize the incidence of venereal infection. Where this was done, as it was done consistently in areas under the control of the Advance Section of the Communication Zone, the troops enjoyed a low venereal disease rate. Where it was not done, the venereal disease rates were a direct measure of the degree to which prostitution was tolerated, condoned or encouraged.

Obviously it was impracticable for the headquarters group to initiate and carry out the development of a long range program during the first month after D-Day. The education of troops and the provision of prophylactic materials had been taken care of during the period of training and of mounting the operation, and at this point "on-the-spot" activities had to be left to those who were there. On 6 July however, the Chief of the Division of Preventive Medicine paid a visit to France.

"There he found in Cherbourg houses of prostitution being run for, and indirectly by, American troops, with the familiar pattern of the designation of one brothel for Negro troops and the others for white, with Military Police stationed at the doors to keep order in the queues which formed. This is exactly what had been anticipated and was the specific



Figure 5

France welcomes America.

reason for the incorporation in Circular 49 of the paragraph quoted previously. In consultation with the Surgeon of Advance Section of the Communication Zone*, the undesirability of this procedure was made readily apparent and proper consultation with Command succeeded in having these brothels effectively placed off limits."

During the remainder of the summer of 1944, almost the only control methods applicable were the provision of prophylactic facilities and the utilization of the off limits authority. During the first months of the continental operations all towns were placed off limits as a matter of general policy, with the principle of the prevention of the venereal diseases only of secondary consideration. Fig. 6. As the supply lines lengthened; as Cherbourg became more and more important as a port and as larger cities, such as LeMans and Rennes were captured and developed into supply centers with complements of static troops, a more selective use of the off limits authority was developed. There was no unanimity of opinion, however, as to how it should be used, or for that matter as to the attitude which should be adopted with regard to prostitution.

"...The history of venereal disease control problems in France has been largely one of differences of opinion, between those who favored segregation and licensure of prostitution and those who opposed it. Unfortunately, the subject being what it is, it has never been possible to gain a free and open discussion; it is generally accounted that since the War Department policy is clearly stated and specifically directs repression of prostitution, it is necessary to give apparent support to such a policy, even while doing the contrary.

"The contrary has been done in many instances in spite of the clear directive contained in Circular 49..."

*It is to be noted that Cherbourg was not under the command of the Advance Section at the time these brothels were being operated in this fashion. The area passed to the Command of Advance Section the day after this recorded conversation and placing the brothels off limits was one of the first command functions exercised.

Prophylaxis.--During this period the most reliable estimates indicated that there was on the average much less venereal exposure than had been taking place among the same group of troops in the United Kingdom. There were at least three readily discernible reasons for this. Early in the campaign large numbers of civilians, especially those of the camp follower type, had either fled before or had been carried with the retreating German Armies. The circumstances of active military operations reduced both the opportunity and inclination for sexual exposure. Finally, the language difficulty interposed a very real barrier during this phase.

In spite of these factors making for a reduction in the amount of venereal exposure and the observations that this was the case, the use of station prophylaxis increased tremendously among troops in France as contrasted to the experience of the same troops in the United Kingdom. It was relatively easy to provide the facilities for this by virtue of the fact that the enemy in garrisoning the towns which we were taking had without exception built and equipped an adequate number of well located prophylactic stations. These were equipped according to standards identical with our own, and aside from the occasional difficulty of providing running water because the local water supply had been disrupted, they were usually ready for immediate use.

Epidemiologic studies.--At this time epidemiologic studies were continued but on quite an elementary basis, since the military situation precluded the gathering of much accurate information. As static troops were moved in for the operation of the supply line, the same type of routine epidemiologic studies which were done in the United Kingdom were organized. Fig. 7.

Cooperation with other agencies.--In the process of cooperation with other agencies a new element which had not been previously encountered was introduced - the G-5, or Civil Affairs Branch of the Army. This agency sometimes created extraordinary complications, since apparently there was no over-all policy or procedure concerning venereal disease control in the organization, and there were virtually as many different policies as there were Civil Affairs Detachments in operation. Just as was true in Command, these ranged all the way from an enlightened attitude toward the role of prostitution in the spread of the venereal diseases to a firm conviction that the operation of brothels was a duty which the Army owed to the individual soldier.



Figure 6

Towns were placed "off limits" as soon as occupied, St. Michel, France, 1944.




Figure 7

The small town cafes welcome American soldiers, Littry, France, July 1944.

Where civilian governments continued to exist they were at this time exceedingly willing to be cooperative but in general unable to do anything for us or their own population that we could not do ourselves. With regard to the repression of prostitution, many of the French thought we were mildly mad, but their temper at that time was to assist us to do anything that we wished.

Consultation with command.--During this period was limited almost entirely to a discussion of the desirability or undesirability of operating GI brothels. In some instances the effort was made to educate officers who believed that the Army should operate brothels for the benefit of the soldiers, but it was soon learned that such educational efforts were largely futile. Apparently a belief in the desirability of licensed prostitution is not subject to logical analysis or discussion but instead is based on the sort of faith that leads a small boy to believe that if he places a horsehair in a bottle of water it will turn to a snake.

The Continental Phase from Paris to the Rhine.--In the liberation of Paris in the last days of August 1944, the general picture again changed. For obvious reasons Paris quickly became the center of operations for our activities on the continent; the number of troops stationed there rapidly increased; the city became the natural objective of every soldier on pass or furlough; and countless numbers of soldiers in groups all the way from one or two to entire convoys "got lost" on their way from hither to yon and wound up in Paris for a bit of sight-seeing. The German occupation had done nothing to improve the morals and behavior of the Parisian women of the brothels and boulevards and the lack of food, and later of fuel, gave the American soldier with a K-ration an unbeatable bargaining position. Fig. 8. 

The immediate result was the venereal disease rate began to rise rapidly; an increase which did not level off until the rate had approximately doubled. Here again the previously employed methods of control were placed into operation, but again it was necessary to rearrange the emphasis. In the first place, it was necessary to go all over again with the Command of the Paris area the problem of prostitution:

"On 2 September 1944 the Provost Marshal of the newly formed Seine section (Paris and vicinity) stating that he was acting at the direction of the Commanding General, made a tour of Paris brothels accompanied by a representative of the Brigade Mondaine for the express purpose of selecting certain

houses of prostitution to be set aside for officers, others for white enlisted men, and still others for colored enlisted men. This policy was somewhat interfered with by protest from the Chief Surgeon..."

Education.—During this period the educational program again had to be largely developed locally because of the difficulty of getting the necessary transportation priority to bringing in supplies. Helpful and newsworthy stories were published by Stars and Stripes and as base sections developed on the continent and venereal disease control officers were assigned thereto, the program of word-of-mouth education was continued. Fig. 9.

Prophylaxis.—With the liberation of Paris the demand for prophylactic facilities in that city became enormous and was well supplied under the auspices of the Venereal Disease Control Officer of the Seine Section. Elsewhere in the larger cities as they were occupied, the policy was continued of attempting to acquire space for prophylactic stations in the American Red Cross Hostels. This was not quite so successfully accomplished as was the case in the United Kingdom, but a number of such installations were made and successfully operated. During this period adequate supplies of individual prophylactic materials, both chemical and mechanical, were available.

Epidemiologic studies and cooperation with other agencies.—Even before the liberation of Paris it had been possible to get routine epidemiologic studies under way in the areas in which the troops were static. Shortly after the United States Army reached Paris, through the cooperation of the Ministry of Health of the DeGaulle Government, it was possible greatly to extend these studies and they soon approximated in scope and detail the well organized scheme which had been conducted in the British Isles. Not the least important of these was a weekly analysis of the place of exposure which during the latter part of 1944, consistently showed Paris to supply a large fraction, sometimes as much as two-thirds, of all the venereal infections acquired in France.

Contact investigation was already under way in Cherbourg at the time Headquarters were established in Paris and was soon extended to include all of the areas in which large numbers of static troops were located. It did not operate as successfully in France as had been the experience in England, primarily because the language difficulty made it less frequent for the soldier to be able to give



Figure 8

The Paris boulevards were the center of all GI ambitions for leave.



Figure 9

Athletic contests were fostered as a form of substitutive activity, 10th Armored Division, Garmisch-Partenkuchen, Germany, June 1945.

accurate identifying information concerning this venereal contact. With the extensive cooperation of the French Health Authorities, and through them with the French Police, an exceedingly worthwhile contribution was made toward the reduction of the venereal disease problem.

In this regard there is one point which is worthy of emphasis. It was standard policy and procedure to regard the activities of the Medical Department in venereal disease control as strictly related to medical and public health activities, reserving the policing aspects of venereal disease control to the military police on the one hand and their cooperative relationships with civilian police on the other. Certain individuals from time to time departed from this, but the policy itself was unvarying and was generally accepted and applied. This had two important effects, both of which may seem at this range to involve legal hairsplitting, but both of which were at the times and places in which they were applied, of crucial importance in avoiding the creation of unpleasant incidents between the American Army and the civilian population.

The first one was that epidemiologic information concerning a civilian venereal contact was invariably transmitted by us to the appropriate health agency. We knew, of course, that local custom in most instances resulted in that information being handed forthwith to the police without intermediate action on the part of the health officials, but nevertheless our dealings were entirely with the health agency.

The second point was that where, as they did in many instances, our military police accompanied the civilian police in raids or on other occasions in which they might be apprehending civilian women, they went along for the real purpose of protecting the civilian police from American soldiers in case there happened to be any about who resented the apprehension of the civilian women.

Since we were alone in our particular sphere of influence at this point there was very little opportunity for cooperation with other military agencies. Such as there was, however, continued the close and cordial relationships which had been experienced in the United Kingdom and formal exchange of courtesies with the appropriate officers of the French Army was done in every instance in an atmosphere positively reeking with goodwill. The details of cooperation with the French civilian health authorities have been previously described:

"Not the least helpful of the present activities is the cooperation which has been gained from the French Ministry of Health." Monsieur Cavaillon, who is the Chief Medical Officer of the Ministry, has long been interested in the venereal diseases and was not only willing, but positively eager, to offer us any cooperation which was possible in venereal disease control. He realizes the crucial importance of the venereal diseases to French public health and also is keenly aware of the undesirability of legalized prostitution. There have been many meetings with Monsieur Cavaillon, the first on 31 August. The most important meeting, however, was on 8 September, when he was presented with a letter from the Chief Surgeon for transmittal to the Acting Minister of Health, requesting cooperation of the French in excluding our troops from brothels. This eventuated on 15 September in a letter from the Minister of the Interior to all Prefects of Police in France, informing brothel keepers that they must exclude American military personnel from their premises on penalty of having the brothel closed for violation. The French have made a serious effort to implement this regulation, but unfortunately in many areas, the local American commander has been unable, or unwilling, to assist in the policing problem involved. The French quite understandably refuse to attempt the policing of United States soldiers without help from our military police, so the brothels flourish.

"The lack of consistency reflected here has led the French health authorities to believe that we are mildly confused in reconciling the established policy with actual procedure. The Chief Medical Officer of the Ministry of Health was quite uncomplimentary in the comments that he made concerning a report to him from the medical officer of the Department of the Meuse concerning the operation of brothels in Commercy and elsewhere by the United States Army.

"On the strictly medical level, however, there has been worked out a cooperative scheme between ourselves, the Ministry of Health and local health authorities, from which is being built an effective control system, based primarily on contact tracing. At the present time this is being somewhat impeded on the one hand by the difficulty of getting reliable identifying information from American soldiers regarding their French contacts, and on the other by the lack of personnel on the part of both ourselves and the

French civilian authorities to do the field epidemiologic work. Increasing familiarity with language and place names is serving to ameliorate the former difficulty and as the years ends there is some hope that a temporary loan of nurses from UNRRA may relieve the problem of personnel."

With the liberation of Belgium, in general the same policies and procedures were practiced as had been developed for France. The Belgians proved themselves to be most cooperative and in Liege, which was the only one of the large cities in our zone of influence, and which late in 1944 and early in 1945 became the hub of the supply system for the front, the cooperative relationship between ourselves and civilians was excellent. Fig. 10.

"On 28 March 1945, there began at the Hospital Recollets in Liege, the final step in a complete venereal disease program for that community and our troops stationed there. Since November there has been a well organized and efficiently functioning venereal disease program, including a contact tracing scheme which has worked out in cooperation between ourselves and the civilian authorities. It has been handicapped, however, by the lack of adequate treatment for the women found to be infected. Because of the unique situation in Liege and particularly the high degree of cooperation which has been given by the civilian authorities, authority has been granted to utilize 400 ampules of penicillin a month in the treatment of selected civilian women. The protocol of the procedure is attached as inclosure 9. This protocol and the circulars to which it refers, have been translated into French and Flemish for the benefit of the various staffs of hospitals and the first patients have been treated."

The directive referred to provided that penicillin would be used for no other purpose than for the treatment of women known or reasonably suspected of being sex contacts of United States soldiers with a venereal disease, excepting when they were found to have late syphilis. The treatment was directly under the supervision of an officer and nurse of the Medical Department of the United States Army and carefully drawn criteria for diagnosis and determination of cure were supplied.

During this period the consultations with Command were limited almost entirely to efforts to break up the still existing habits of many commanding officers of punishing noncommissioned officers for acquiring a venereal disease by reducing them to ranks. This is exemplified by the publication by the Commanding General of the Headquarters Command of ETOUSA of a directive creating an efficiency board to review the case of any non-commissioned officer who acquired a venereal disease with accompanying memorandum to the members of the Board making it clear that the Commanding General expected every noncommissioned officer brought before this board for having had a venereal disease to be reduced to ranks for inefficiency.

The Continental Phase After the Investiture of Germany.--

After the invasion of Germany, two new problems of crucial importance were encountered. Both of these had been anticipated, but for neither had there been made satisfactory plans. The first of these was the problem created by displaced persons. These had been encountered before the actual invasion of Germany had taken place but were found in increasing numbers as the Armies pushed deeper into Germany and released the camps of slave labor.

The social and economic problems which these people presented were terrific. The circumstances under which they had been living were such as to leave them with virtually no sense of moral responsibility. Promiscuity was the rule rather than the exception and the incidence of the venereal diseases among them must have been high, although there was no reliable information on this subject.

The second of the problems was that caused by the non-fraternization policy:

"In anticipation of the special problems which would arise with the cessation of hostilities, the effort was made to obtain clarification of policy with regard to the venereal diseases acquired in enemy countries. As early as November 1944, a decision was requested regarding the advisability of application for prophylaxis or for treatment for venereal disease being considered as prima facie evidence of fraternization with the enemy. No clear statement of policy was obtained, so that with the occupation of Germany, especially after the cessation of hostilities, there was lack of uniform policy. Some commanders attempted to establish a program, but others went so far as to refuse to establish prophylactic stations on the assumption that to do so would be encouraging



Figure 10

A house of prostitution in Liege, Belgium, is placed "off limits" to U. S. troops, October 1944.

fraternization. In some organizations, men were tried before a summary court-martial, and fined the usual \$65, simply for reporting with a venereal disease. An Adjutant General letter order of 4 June 1945 clarified the situation:

"2. The contraction of venereal disease or the facts concerning prophylactic treatment will not be used, directly or indirectly, as evidence of fraternization or as evidence of violation by the individual of the policy on non-fraternization with the inhabitants of Germany."

With the slowing down of the Armies and the final cessation of hostilities, the supply problem became very much better, and at long last, in the late spring of 1945, a series of shipments of venereal disease posters totaling 70,000 was received from the United States. This represented the first poster material received for distribution in the European Theater of Operations proper, although sometime prior to the date of the receipt of this material on the continent, similar supplies had been received in the United Kingdom Base. Copies of the educational films "Pick-up" and "For Your Information" also were made available during this period.

The cessation of hostilities was followed immediately by a sharp upward trend in the incidence of the venereal diseases. Unfortunately, this skyrocketing venereal disease rate was accompanied by such a kaleidoscopic shifting in the make-up of the commands in the theater and the complete redistribution of responsibility, that during this period very little which was effective in organized venereal disease control could be accomplished. Fig. 12.

Another minor misfortune occurred at this time in the withdrawal from issue of the V-Packette and the substitution therefor of the one-tube prophylactic kit of which adequate supplies were not available. This created a critical supply problem for what was already a critical period in the venereal disease experience of the theater and there was much speculation as to whether or not this limitation of prophylactic supplies materially contributed to the increasing venereal disease rate.

Prior to this period the issue of condoms had been cut from six per man per month for issue and an average of 1.7 per man per month for sale through the post exchanges, to a total supply of four per man per month for both issue and sales purposes. This otherwise undesirable move had been necessitated by directions from The Surgeon General's Office based on the supply problem.

Efforts were made to continue epidemiologic studies but with the cessation of hostilities and the tremendous amount of troop movement which developed immediately thereafter, these proved to be of less value than at any time during the life of the theater.

Cooperative relationships with other agencies which had been developed were maintained and during this period a beginning was made toward the development of a venereal disease control program, applicable to the people of Germany for the protection of the Army of Occupation.

Prevalence and Incidence of The Venereal Diseases --It remains to assess the conditions that existed and the methods that were used in the control of the venereal diseases in terms of the amount of venereal infection experienced by troops of the United States Army; and to examine the distributions of the several diseases among various elements of the United States forces in Europe. The total venereal disease rate will be used as the index.

The initial phase of operations in Europe has been defined as the period dating from the arrival of troops in February 1942 through the mounting of operation TORCH at the end of 1942. During the early months of the theater, the rates for the venereal diseases were decidedly good as would be anticipated for troops newly arrived in a strange country, with much to do in becoming established in a new environment and in building a military structure. For the first eight months of 1942, until September, the rates for troops in the European Theater of Operations were better than those for the United States, despite long experience in many wars that higher rates are almost an invariable experience among troops away from home. For a goodly part of this time, the theater rates were half these of troops for the Zone of the Interior.

As greater acquaintance developed with the United Kingdom, and as the first flush of other interests in a new country subsided, the rates for the venereal diseases began to increase. This was first noticeable in August and progressed continuously through December, to reach a rate of 58 per thousand per year which was never again duplicated until the troops reached France.

The experience of the early months of the second phase of operations in the United Kingdom was characterized by a more or less fixed incidence of the venereal diseases at a level slightly in excess of 50 per thousand per year, after which a steady, downward trend took place in the frequency with which these diseases were noted. It continued until D-Day and the invasion of Normandy. The annual rate for 1943 was 43, compared with that of 26 for home troops in the United States.



Figure 11

Fraternization "verboden" for 101st Airborne
Division soldiers, Konigsee, Germany, June 1945.



Figure 12

A soldier of the 42nd Infantry Division and his girl stroll through Vienna woods, June 1945.

The decidedly low level to which rates for the venereal diseases had declined in 1944 was one indication of the seriousness with which American soldiers undertook the obligation of preparing for the invasion, and of the hard work that went into it. For a number of months just before D-Day, the rates for theater troops were actually better than those for troops in continental United States. The increase just prior to D-Day was much less than had been anticipated as a result of the frequently expressed "last fling" attitude.

Normandy became the business of the day and troops engaged in the assault on the continent had such an excellent record in respect to venereal diseases that the rates for the entire theater were carried with it, and venereal disease in the army dropped to a level of 20 per thousand per year; a truly excellent record of itself and one which essentially matched that of the early days of the theater but unfortunately was never to be attained again.

The average rates for the venereal diseases among troops of the United States Army stationed on the European continent were never as good as those which marked their stay in the United Kingdom. It was appreciated in advance that they would not be. A rate of 25 per thousand per year had been set as the criterion of satisfactory control in the United Kingdom. Based on the same standards of a reasonably attainable goal, a rate of 50 was taken as a satisfactory basis upon which to judge European performance.

The rates became greater as continental operations were extended. The effect of the transfer of theater headquarters and of general activities to Paris was evident when the rates for October touched 58. A moderate improvement was noted in the next succeeding months and indeed the curve of incidence acquired a fastigium as it had in England once conditions became more or less stabilized.

The approaching end of the war and the contact with new people and new conditions led to a decided rise in rates in March and April. When VE-Day finally arrived, the inevitable let down took place and the rates for venereal diseases soared. Those of May were greater than in April and June saw the highest rate in the history of the theater, with every indication that the end was not yet and that the army of occupation would have an experience with those communicable diseases greatly exceeding that of the period of war time operations.

Venereal Disease in the Major Forces.---The average long term incidence of the venereal diseases in the United Kingdom was maintained at a satisfactory level. Nevertheless the three principal forces constituting the command, the Ground Forces, the Air Forces and the Services of Supply showed certain variations in the frequency with which these diseases occurred. The year 1943 is taken in illustration, (Table 1, Figure 13) of experience in Great Britain and the period September 1944 to June 1945 for continental operations. Troops of the Ground Forces regularly and consistently had the best record in the United Kingdom. There was not much to choose between the experience of the Services of Supply and that of the Air Forces, but in general the highest rates for any of the three groups were among troops of the Air Forces, the only troops then actively engaged in combat. Much the same relationship was maintained during operations on the continent, although no doubt existed then that Communications Zone troops outdistanced all others.

The Air Forces continued a very close second. The best rates by far were those of the Ground Forces, although for the final month of the theater, June 1945, the Group Forces came into their own and led all three forces with a rate for the month of 140 per thousand per year.

The Ground Force Replacement Command, a continental organization, had decidedly high rates for the venereal diseases throughout the course of operations. Comparison with the Ground Forces themselves is striking. If the entire period of continental operations is considered, the ranking position of the Communications Zone remained safe, but the Ground Force Replacement Center ended with a burst of speed at the end that outdistanced all others. The venereal disease rate for that organization in June 1945 were 153 per thousand per year.

The Services of Supply and the Communications Zone.---Three large base sections, the Western Base Section, the Eastern Base Section and Southern Base Section, a smaller Central Base Section which included the metropolitan district of London, and the North Ireland Base Section, somewhat isolated and of lesser troop strength, comprised the organization of the Services of Supply in Great Britain.

Over the course of the many months in the United Kingdom, the Western Base Section had the poorest record of the several base sections (Table 2, Figure 14). The rates in the Eastern Base Section were always relatively high. The best long term record of the three principal sections went to the Southern Base Section, considering troop strength

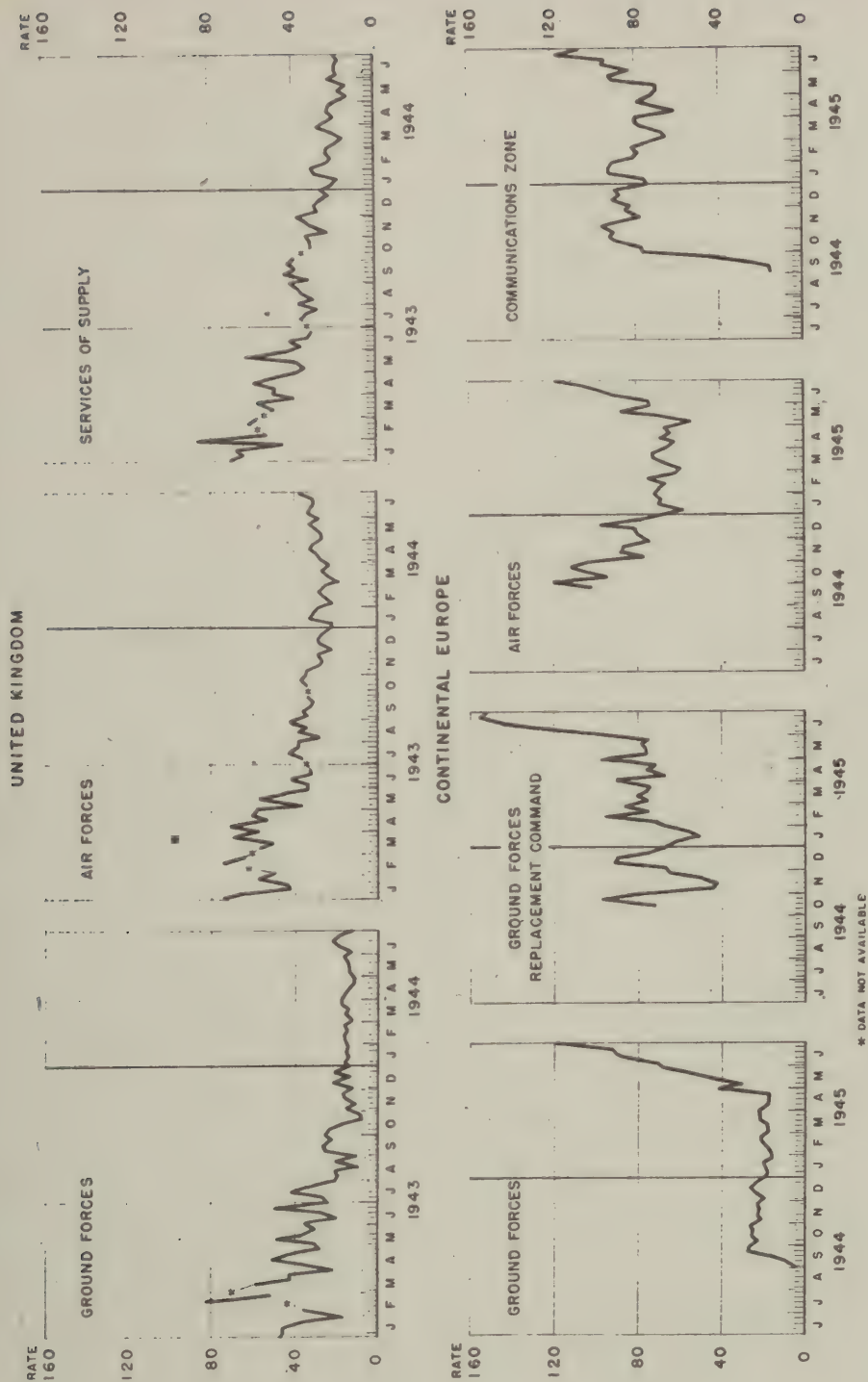


Figure 13. Venereal diseases, all forms, European Theater of Operations, U. S. Army, by Major Commands in Great Britain, 1 January 1943 to 30 June 1944 and on the Continent, September 1944 to 29 June 1945, rates per 1000 strength per annum, by weeks.

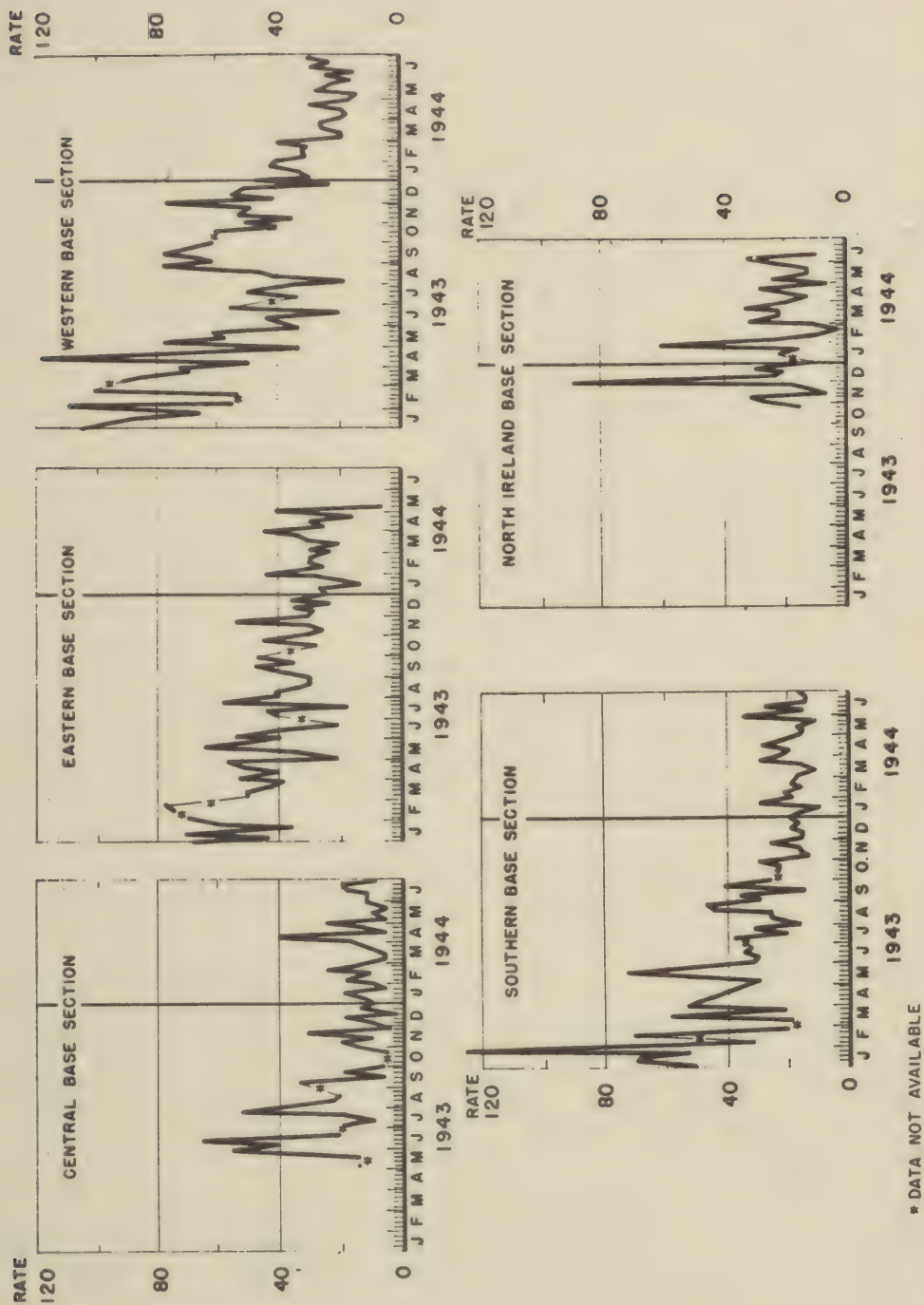


Figure 14. Venereal diseases, all forms European Theater of Operations, U. S. Army, base sections of the Services of Supply in United Kingdom, rate per 1000 strength per annum, by weeks, 1 January 1943 to 30 June 1944, inclusive.

and the concentration of activities in that region. Particularly favorable comment is directed to the Central Base Section in London, with a first class record achieved under difficult circumstances. The program of control was under competent direction and had the active support of command. The North Ireland Base Section had a consistently good performance.

There was not much to choose among the various Sections of the Communications Zone in France. The rates for all were higher than the theater average and that of the Seine base section in Paris maintained leadership with no difficulty, until it yielded precedence to the Delta Base Section as that organization came into the European Theater in November 1944 (Table 3, Figure 15). No single major organization of the theater ever approached the rates that organization had in the Marseilles region.

Venereal Diseases in the Air Forces.---The Eighth Air Force remained continuously in Great Britain and the rates for the venereal diseases quoted for Air Forces in Great Britain are essentially those of the Eighth Air Force. The Ninth Air Force operated on the continent, and continental Air Force troops were principally of that command.

Venereal diseases among men of the Ninth Air Force were more frequent than for those of the Eighth Air Force; but the differences were not great, and the spread was by no means comparable to that for Communications Zone troops under the two conditions, (Table 4, Figure 16).

Venereal Diseases in The Field Armies.---Until completion of active operations in May 1945 the venereal disease rates for field armies were consistently the best of all troops of the theater, so much so that there was scant comparison. Differences between the five armies constituting the Ground Forces are difficult to demonstrate, (Table 5, Figure 17). Sometimes one army would have the better record for a month or so, sometimes another. The behavior of all was characterized by a sharp rise as the war ended, with no question remaining of where the explanation lay for the greatly increased rates of the theater as a whole, which characterized the final weeks.

Venereal Disease in the United Kingdom and on the Continent During Active Operations.---Venereal Diseases were very definitely more frequent among troops serving on the continent than among those in the United Kingdom Base. The commonly expressed belief that the

greater rates for the theater during the time of active operations was completely an expression of the forces serving on the continent was not wholly true, for the venereal diseases were more common in both localities. The rates in the United Kingdom were 47 per thousand per year compared with 35 for the year 1944; and the frequency of these conditions among troops on the continent was no more than 59. The general increase was a function of both commands. (Table 6).

Racial Differences in Rates for Venereal Diseases.---The usually observed differential between venereal diseases among white and colored populations was consistently observed among troops of the United States Army serving in Europe. The rates for both groups were higher on the continent than in the United Kingdom, but the relative difference remained almost identical, about 4.5 to 1. (Table 7, Figure 18).

The Kinds of Venereal Disease.---The distribution of the venereal diseases according to clinical form, grouped as syphilis, gonorrhea and others, is presented in Table 8, for the four different years of the European Theater. Gonorrhea constituted the great bulk of infections; the rates for syphilis remained fairly similar throughout the years except for a rather well-marked increase in 1943, when the proportion of syphilis to other forms of venereal disease was increased. The rise in rates for the group classed as other venereal diseases and noted in 1945 was distinctly related to the troops arriving in the European Theater from Italy, where the incidence of chancroid was measurably great. The monthly reports of syphilis show a uniform distribution throughout each year. The high incidence in 1943 is shown to be particularly a function of the latter part of that period. (Table 9). Similar data are presented for gonorrhea in Table 10.

Comparison with Other Theaters of Operation.---Comparison of the rates for the venereal diseases among troops of the European Theater with those of American troops serving at home shows the experience of the theater to be commendable. The rates were greater, but rates are always greater among troops serving in a foreign country. Compared with the experience of the British Army serving at home, the rates for American troops in Great Britain were measurably higher. (Figure 19).

Among American troops of the various theaters of operation, the European theater fared much better in comparison. The highest average rate attained in any theater was that in the Mediterranean,

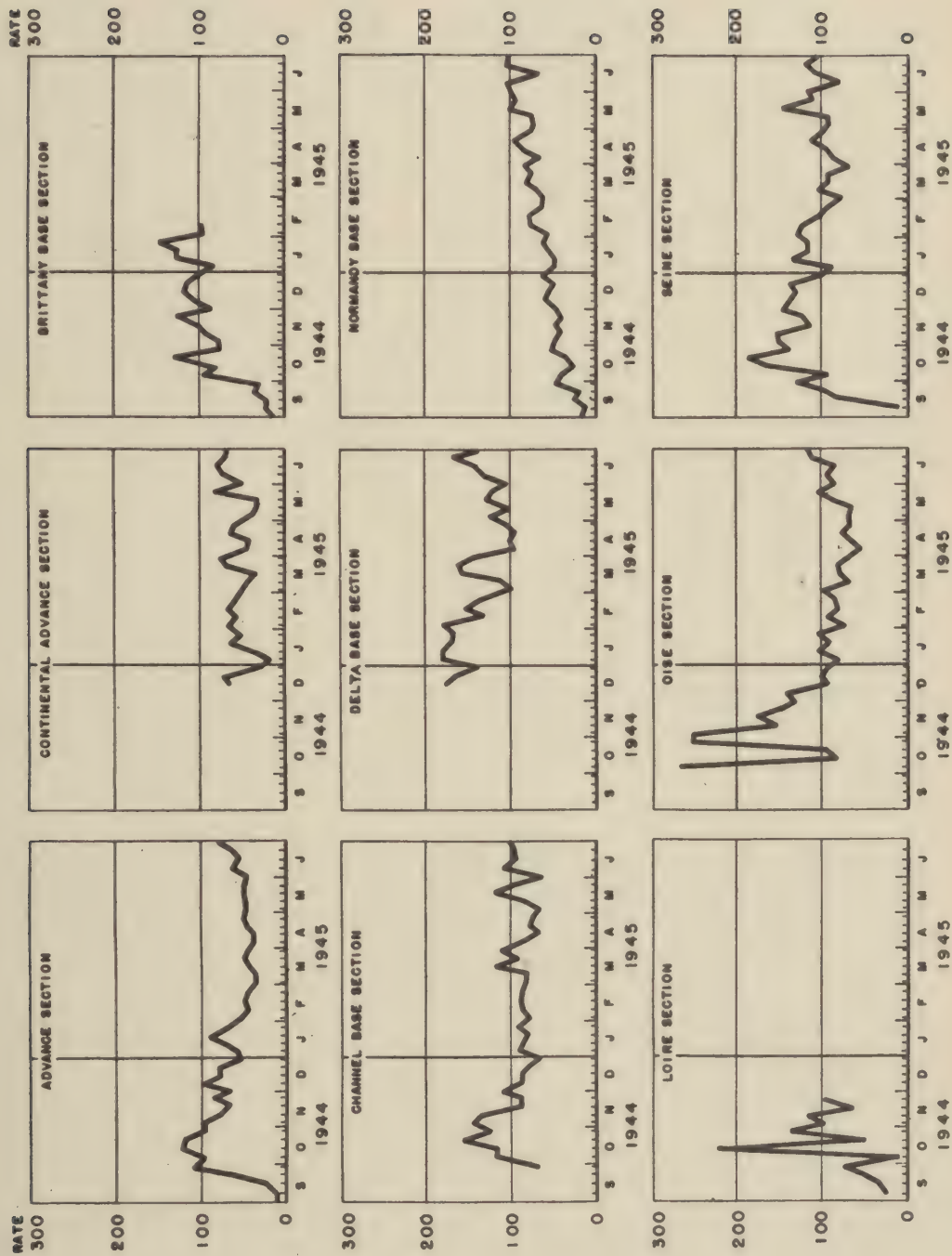


Figure 15. Venereal diseases, all forms, European Theater of Operations, U. S. Army, base sections of the Communications Zone in Continental Europe, rates per 1000 strength per annum by weeks, 1 September 1944 to 9 June 1945, inclusive.

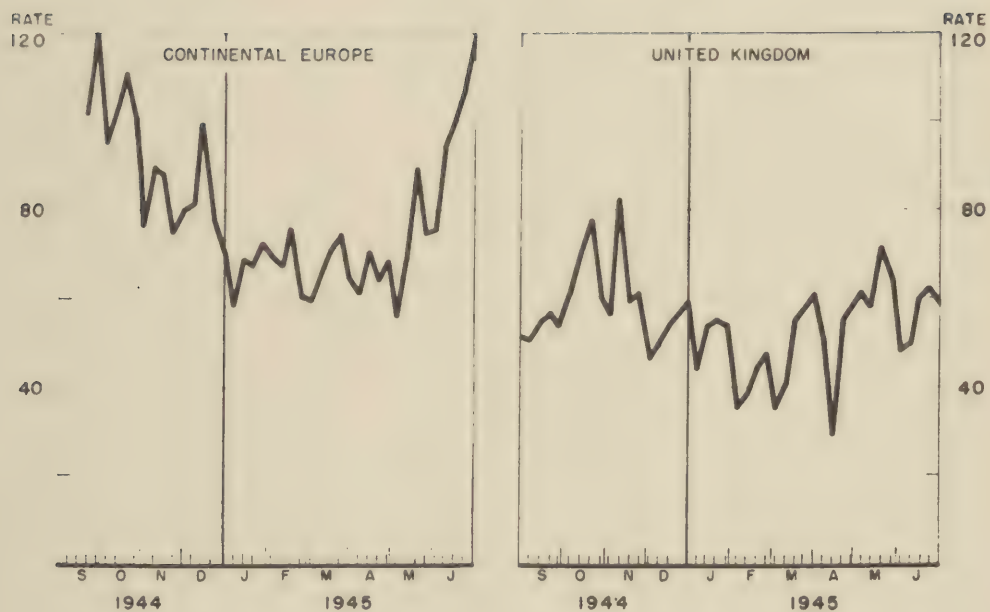


Figure 16

Venereal diseases, all forms, European Theater of Operations, Air Force in United Kingdom and on the Continent, rates per 1000 strength per annum by weeks, 1 September 1944 to 29 June 1945.

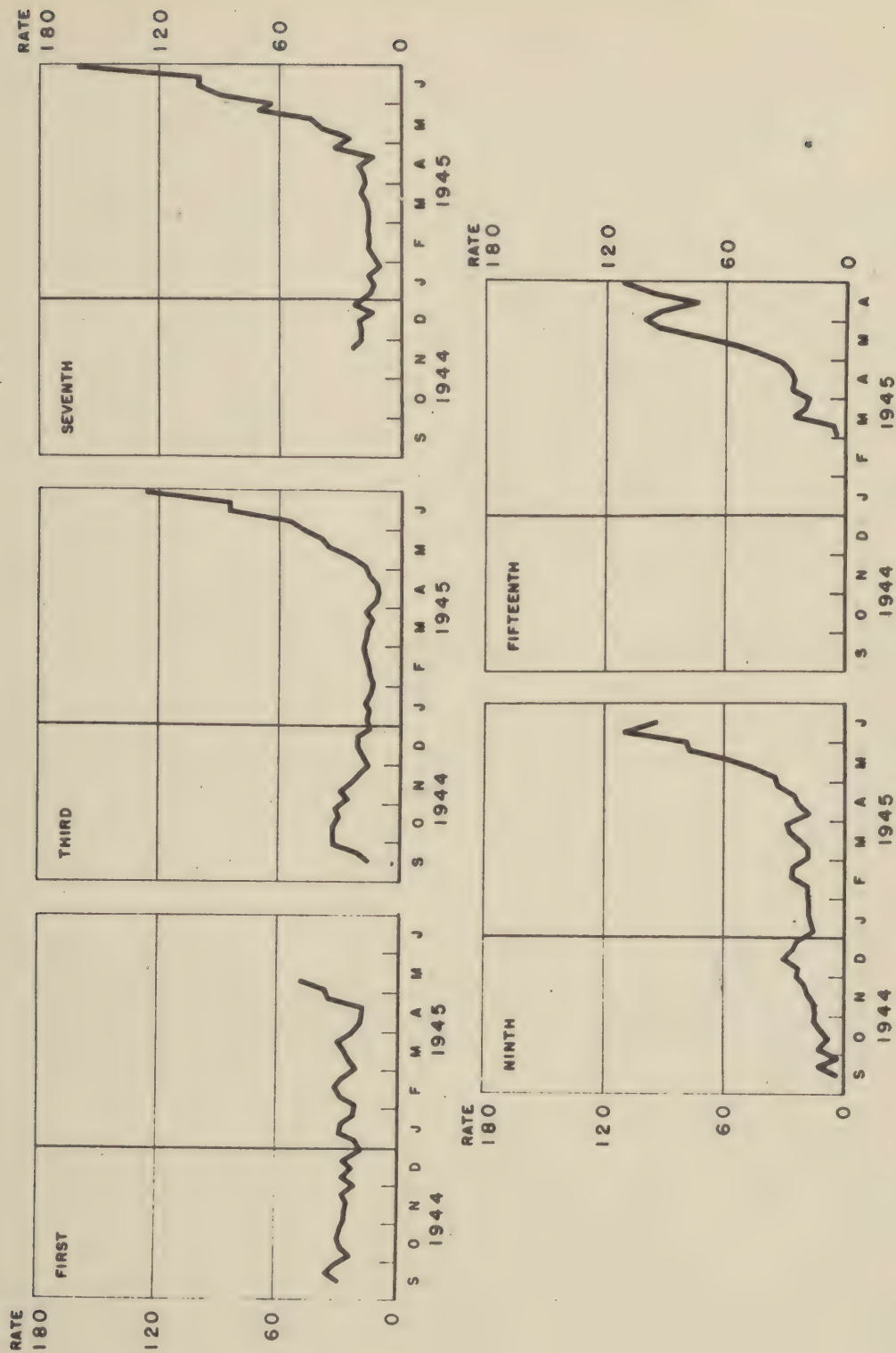


Figure 17. Venereal diseases, all forms, European Theater of Operations, U. S. Army, Armies in Continental Europe, rates per 1000 strength per annum by weeks, 1 September 1944 to 29 June 1945.

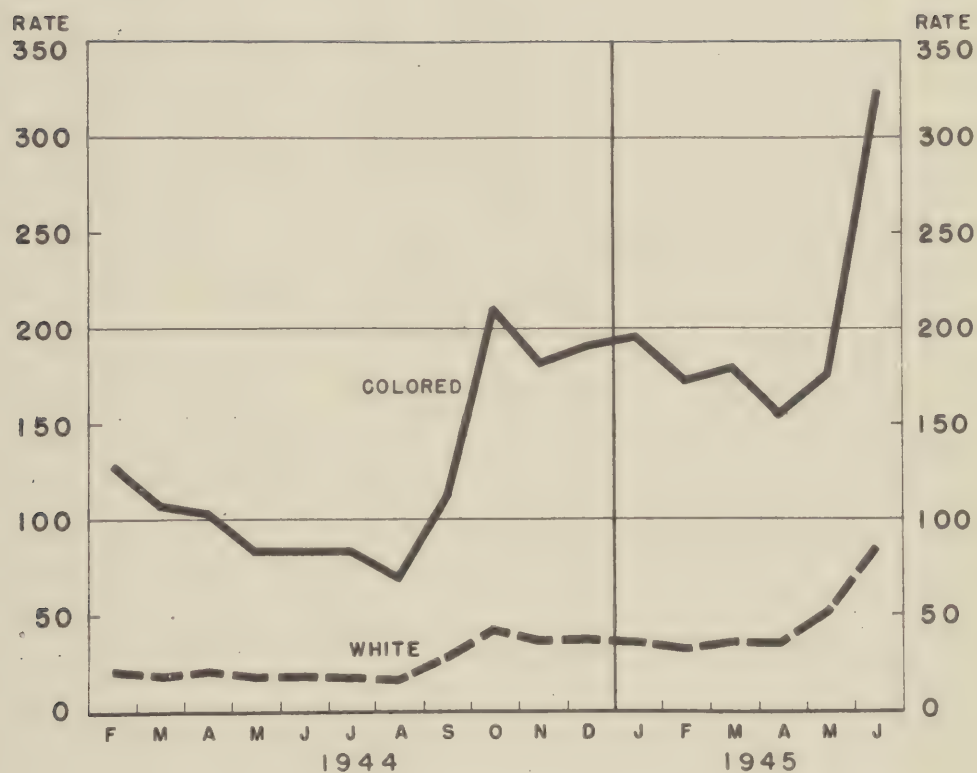


Figure 18

Venereal diseases, all forms, European Theater of Operations, U. S. Army, colored and white, cases and rates per 1000 strength per annum by months, February 1944 to June 1945, inclusive.

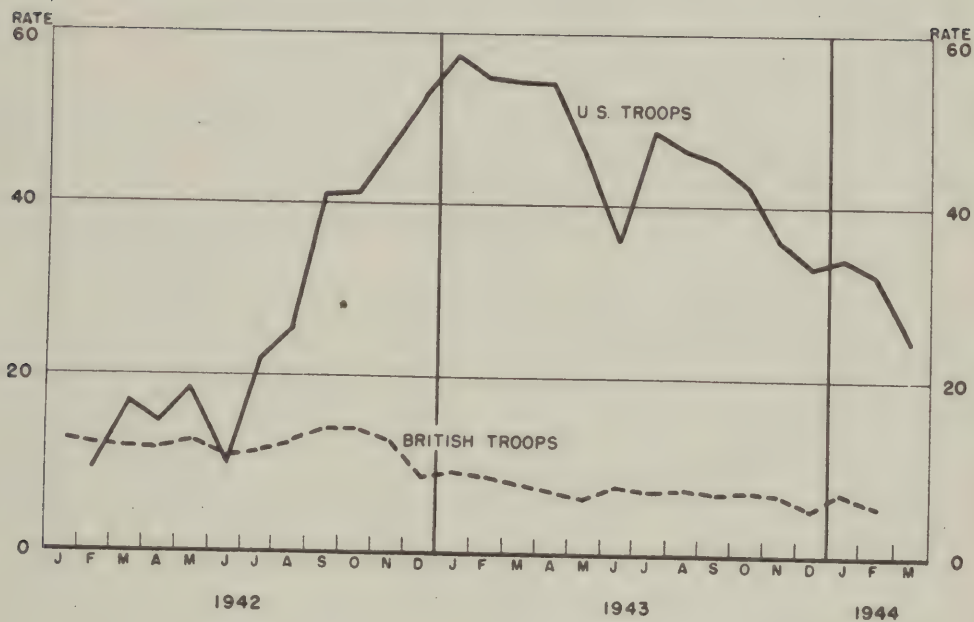


Figure 19

Venereal diseases among British and American troops, United Kingdom, January 1942 to March 1944.

with an overall rate of 90.5. The African and Middle East theater was next with a rate of 67, and Latin American was close up with 54 per thousand per year. The overall rate of the European Theater of 47 rates fifth place among the nine theaters of operations of the United States Army. (Table 11).

Personnel in Venereal Disease Control at Theater Headquarters.---

The Venereal Disease Control Branch was continuously under the direction of Major (later Lt. Colonel) Paul Padget, MC. He took over responsibility on 26 September 1942 and remained until activities ceased 30 June 1945. Captain (later Major) Raymond Heitz became his principal assistant on 18 January 1943 and served continuously throughout the operations. Captain (later Major) Charles P. Anderson, joined the division the same day and remained for more than a year, until he took up duties as venereal disease control officer in Eastern Base Section and later in Seine Section, Paris.

A number of nurses served with the branch in connection with case finding activities. They included 2nd Lts. Marie C. Goik and Margaret F. Malley, who were assigned to duty 6 September 1943. Among others subsequently engaged in this feature of venereal disease control were 2nd Lts. Eleanor C. Mikkelsen, Marjorey B. Storey, Ethel Hammond, Rosalie C. Giaceme, Marjorie E. Davies, Catherine L. Whyts, Harriette M. Malone and a number of others.

Table 1

Venereal Diseases, All Forms
European Theater of Operations, U. S. Army
by Major Commands, in Great Britain
1 January 1943 to 30 June 1944,
and on the Continent 1 September 1944 to 29 June 1945,
Rates per 1000 strength per annum, by weeks

Week Ending	UNITED KINGDOM		
	Ground Forces	Air Forces	Services of Supply
1943			
Jan 1	47	75	71
8	47	63	65
15	46	42	68
22	37	45	46
29	17	59	88
Feb 5	34	49	52
12	*	*	*
19	83	76	62
26	53	64	58
Mar 5	*	*	*
12	60	58	50
19	42	50	57
26	44	70	39
Apr 2	22	57	50
9	37	72	49
16	51	53	59
23	42	60	50
30	30	58	40
May 7	32	35	35
14	48	57	40
21	36	47	63
28	31	34	44
June 4	35	34	37
11	20	43	42
18	27	31	33
25	50	33	30
July 2	*	*	*
9	24	36	36
16	27	44	33
23	43	39	29
30	35	39	38
Aug 6	21	29	29
13	20	40	35
20	21	36	37
27	10	43	41

Table 1 (cont'd)

Week Ending	UNITED KINGDOM		
	Ground Forces	Air Forces	Services of Supply
Sept 3	21	33	33
10	10	37	45
17	26	33	40
24	27	32	43
Oct 1	22	35	40
8	26	*	*
15	23	34	31
22	18	37	32
29	8	35	34
Nov 5	9	35	23
12	16	29	30
19	11	28	35
26	17	28	30
Dec 3	18	23	28
10	13	29	31
17	22	30	27
24	13	26	23
31	20	22	26
1944			
Jan 7	14	23	20
14	16	33	19
21	15	31	30
28	16	29	31
Feb 4	15	23	24
11	16	26	21
18	16	28	24
25	15	27	23
Mar 3	17	21	20
10	13	23	15
17	16	27	21
24	15	23	28
31	17	28	24
Apr 7	18	29	20
14	16	33	23
21	14	31	23
28	13	28	18
May 5	11	28	14
12	14	30	19
19	14	33	15
26	17	29	23
June 2	13	33	18
9	19	32	20
16	22	31	20
23	19	31	17
30	12	38	19

Table 1 (cont'd)

Week Ending	CONTINENTAL EUROPE			
	Ground Forces	Air Forces	ComZ	GRFC
1944				
Sept 1	4		15	
8	10		15	
15	17		27	
22	27	102	45	
29	28	120	76	
Oct 6	24	95	78	
13	26	103	88	73
20	26	111	93	98
27	27	101	90	80
Nov 3	21	77	96	46
10	23	89	86	42
17	22	87	78	48
24	23	75	85	66
Dec 1	20	81	83	67
8	24	82	91	93
15	27	99	88	90
22	24	78	89	74
29	21	70	74	68
1945				
Jan 5	19	58	76	61
12	20	69	92	50
19	20	68	93	56
26	17	73	92	67
Feb 2	16	69	81	72
9	19	68	79	95
16	22	76	81	75
23	21	61	73	88
Mar 2	18	60	66	75
9	18	66	67	82
16	22	72	79	67
23	22	74	80	74
30	22	65	80	90
Apr 6	18	62	62	68
13	19	70	71	76
20	18	64	80	72
27	29	68	72	99
May 4	31	56	69	76
11	42	69	70	76
18	53	89	91	79
25	68	74	92	75

Table 1 (cont'd)

Week Ending	CONTINENTAL EUROPE			
	Ground Forces	Air Forces	ComZ	GRFC
June 1	70	75	82	104
8	86	94	96	128
15	91	100	94	143
22	93	107	117	155
29	140	120	107	153

* No data available.

Source: Division of Medical Records, Office of the Chief Surgeon,
European Theater of Operations, U. S. Army

Table 2

Venereal Diseases, All Forms
 European Theater of Operations, U. S. Army
 Base Sections of the Services of Supply in United Kingdom
 Rate per 1000 strength per annum, by weeks,
 1 January 1943 to 30 June 1944, Inclusive

Week Ending	BASE SECTIONS				
	Central	Eastern	Southern	Western	North Ireland
1943					
Jan 1		68	50	107	
8		45	71	97	
15		73	68	88	
22		36	53	67	
29		60	125	110	
Feb 5		71	33	57	
12		*	*	*	
19		75	71	54	
26		79	21	102	
Mar 5		*	*	*	
12		51	19	92	
19		52	58	85	
26		43	21	69	
Apr 2		39	53	73	
9		54	50	49	
16		40	44	118	
23		53	38	67	
30		58	36	33	
May 7	15	21	30	79	
14	0	34	49	58	
21	15	66	73	62	
28	29	52	48	33	
June 4	56	40	32	42	
11	41	54	29	45	
18	66	39	34	21	
25	22	21	33	57	
July 2	*	*	*	*	
9	20	42	37	34	
16	9	44	20	52	
23	18	19	31	46	
30	53	58	16	36	
Aug 6	32	41	26	19	
13	23	42	26	43	
20	22	34	45	47	
27	0	29	46	78	

Table 2 (cont'd)

Week Ending	BASE SECTIONS				
	Central	Eastern	Southern	Western	North Ireland
Sept 3	0	30	29	63	
10	34	37	36	67	
17	7	48	14	79	
24	20	36	41	69	
Oct 1	6	47	27	63	
8	*	*	*	*	
15	0	27	23	61	
22	6	46	22	43	15
29	15	32	29	52	28
Nov 5	20	27	12	36	33
12	10	31	15	55	7
19	32	55	16	50	11
26	4	31	26	78	17
Dec 3	9	28	16	42	89
10	18	36	14	55	24
17	4	24	19	50	21
24	15	37	17	24	29
31	10	24	19	48	11
1944					
Jan 7	13	27	16	30	0
14	20	14	9	34	23
21	6	27	29	44	15
28	9	46	17	41	61
Feb 4	18	26	21	31	24
11	11	31	15	32	11
18	26	30	19	32	4
25	14	23	17	39	10
Mar 3	6	30	17	19	33
10	5	21	10	20	21
17	8	31	15	27	21
24	13	35	29	28	33
31	17	47	22	20	19
Apr 7	41	27	18	18	13
14	5	31	29	19	17
21	13	17	21	29	27
28	25	41	15	16	6
May 5	5	7	14	14	24
12	10		16	27	13
19	5		10	23	13
26	13		35	17	22
June 2	13		15	24	32
9	12		27	15	10
16	18		14	29	
23	21		14	23	
30	7		15	30	

* No data available.

Source: Division of Medical Records, Office of the Chief Surgeon
European Theater of Operations, U. S. Army.

Table 3

Venereal Diseases, All Forms
 European Theater of Operations, U. S. Army
 Base Sections of the Communications Zone in Continental Europe
 Rates per 1000 strength per annum, by weeks
 1 September 1944 to 29 June 1945, Inclusive

Week Ending	Advance Section	Continental Advance Section	Brittany Base Section	Channel Base Section	Delta Base Section	Normandy Base Section	Loire Section	Oise Section	Seine Section
1944									
Sept 1	12		10			16	*		*
8	11		22			14	28		11
15	26		22	*		27	36		83
22	67		36			21	51		98
29	110		28	63		46	72		128
Oct 6	96		96	119		40	10	264	94
13	125		82	117		28	222	82	164
20	122		129	155		35	50	96	186
27	98		76	124		52	135	252	134
3	98		86	144		49	98	250	151
10	80		91	136		42	120	153	153
17	67		101	88		48	63	176	115
24	86	**	125	89	**	40	100	148	121
1	66		88	111		47	***	131	146
8	99		105	87		59		140	136
15	79	63	118	87	178	54		93	128
22	79	73	114	80	165	50		100	136
29	55	29	100	66	139	62		93	98

Table 3 (cont'd)

Week Ending	Advance Section	Continental Advance Section	Brittany Base Section	Channel Base Section	Delta Base Section	Normandy Base Section	Loire Section	Oise Section	Seine Section
1945									
Jan 5	58	16	81	91	179	46		82	88
12	72	33	128	87	179	47		106	133
19	91	62	127	80	169	54		92	115
26	66	50	146	92	167	61		105	115
Feb 2	52	66	96	77	180	56		72	128
9	45	56	98	86	133	76		93	122
16	48	66	***	88	153	79		81	101
23	45	57		87	137	65		83	93
Mar 2	37	49		83	100	60		99	78
9	36	42		82	110	70		70	106
16	43	33		118	155	80		80	92
23	50	69		94	159	74		81	95
30	45	74		111	143	85		69	66
Apr 6	39	46		83	96	63		52	89
13	38	42		66	101	83		65	94
20	46	65		77	96	96		76	111
27	50	60		73	105	76		66	99
May 4	47	39		66	125	72		69	90
11	48	31		87	102	75		65	93
18	50	30		120	128	101		87	145
25	49	81		96	121	93		104	109
June 1	46	50		63	105	99		83	118
8	65	72		109	130	104		94	81
15	57	79		94	140	68		82	109
22	63	69		96	167	103		112	119
29	80	67		101	137	102		119	105

* Activated

** Assigned Communications Zone, ETO

*** Inactivated

Source: Division of Medical Records, Office
of the Chief Surgeon, European Theater of
Operations, U. S. Army

Table 4

Venereal Diseases, All Forms
European Theater of Operations
Air Forces in United States and on the Continent
Rate per 1000 strength per annum, by weeks
1 September 1944 to 29 June 1945

Week Ending		Continental Europe	United Kingdom
1944			
Sept	1		52
	8		51
	15		55
	22	102	57
	29	120	54
Oct	6	95	62
	13	103	71
	20	111	78
	27	101	61
Nov	3	77	56
	10	89	83
	17	87	59
	24	75	62
Dec	1	81	46
	8	82	48
	15	99	54
	22	78	56
	29	70	59
1945			
Jan	5	58	44
	12	69	54
	19	68	55
	26	73	54
Feb	2	69	34
	9	68	38
	16	76	45
	23	61	47
Mar	2	60	35
	9	66	42
	16	72	55
	23	74	58
	30	65	61
Apr	6	62	50
	13	70	29
	20	64	55
	27	68	58

Table 4 (cont'd)

Week Ending		Continental Europe	United Kingdom
May	4	56	62
	11	69	57
	18	89	72
	25	74	64
June	1	75	47
	8	94	49
	15	100	60
	22	107	63
	29	120	58

Source: Division of Medical Records, Office of The
Chief Surgeon, European Theater of Operations,
U. S. Army.

Table 5

Venereal Diseases, All Forms
European Theater of Operations, U. S. Army
Armies in Continental Europe
Rates per 1000 strength per annum, by weeks
1 September 1944 to 29 June 1945

Week Ending	First	Third	Seventh	Ninth	Fifteenth
1944					
Sept 1	1	7			
8	12	9		7*	
15	28	14		4	
22	35	21		11	
29	30	33		4	
Oct 6	23	33		11	
13	27	34		9	
20	30	30		10	
27	27	32		14	
Nov 3	26	25		13	
10	26	30		15	
17	24	23		17	
24	26	20	23*	18	
Dec 1	20	16	20	23	
8	26	18	20	22	
15	22	20	20	29	
22	26	21	14	24	
29	18	14	23	21	
1945					
Jan 5	20	16	15	14	
12	29	15	13	15	
19	28	17	15	16	
26	26	14	10	17	
Feb 2	20	12	12	17	
9	29	14	16	17	
16	30	15	16	26	
23	27	17	16	25	
Mar 2	20	18	16	18	4*
9	23	16	16	18	7
16	26	15	18	23	26
23	30	13	19	22	20
30	21	16	18	29	17
Apr 6	19	10	18	18	26
13	18	10	20	23	26
20	17	11	13	24	26
27	35	15	33	34	31

Table 5 (cont'd)

Week Ending		First	Third	Seventh	Ninth	Fifteenth
May	4	37	17	24	34	42
	11	50	24	39	46	55
	18	**	35	44	60	74
	25		40	70	77	93
June	1		48	64	78	101
	8		56	89	110	94
	15		84	102	92	75
	22		84	101	**	96
	29		126	162		113

* First Report received.

** Redeployed.

Source: Division of Medical Reports, Office of the Chief
Surgeon, European Theater of Operations, U.S. Army.

Table 6

Venereal Diseases, All Forms
European Theater of Operations, U. S. Army
United Kingdom and Continent
Cases and Rates per 1000 strength per annum, by months
September 1944 to June 1945, Inclusive

MONTH	Total		United Kingdom		Continent	
	Cases	Rate	Cases	Rate	Cases	Rate
1944						
September	5695	35	2673	40	3022	31
October	7876	57	2203	53	5673	59
November	7311	48	1935	48	5376	48
December	11223	50	2379	40	8844	53
1945						
January	9472	48	1968	39	7504	52
February	9284	45	1797	38	7487	47
March	12747	48	2454	48	10293	48
April	9985	46	1780	46	8205	46
May	13705	62	1856	62	11849	62
June	27705	105	3048*	66	24657*	113
Total	115003	56	22093	47	92910	59

* Estimated

Source: Medical Statistics Division, Office of The Surgeon General,
War Department, Washington, D.C.

Table 7

Venereal Diseases, All Forms
European Theater of Operations, U. S. Army
Colored and White

Cases and Rates per 1000 strength per annum, by months
February 1944 to June 1945, Inclusive

	Total			White			Colored		
	Cases	Rates		Cases	Rates		Cases	Rates	
1944									
February	2115	30.1		1426	22.0		689	127.3	
March	2590	25.1		1775	18.6		815	106.4	
April	2451	26.4		1707	19.9		744	102.9	
May	2291	22.8		1632	17.6		659	82.5	
June	2993	23.5		2137	18.1		856	83.3	
July	2371	21.8		1753	17.3		618	83.1	
August	2594	20.4		1906	16.3		688	69.0	
September	5695	34.8		4282	28.3		1413	113.5	
October	7876	56.6		5469	42.8		2407	212.1	
November	7311	48.0		5027	35.9		2284	182.4	
December	11223	49.5		7764	37.2		3459	190.8	
1945									
January	9472	48.3		6179	34.5		3293	196.2	
February	9284	45.1		6290	33.3		2994	173.3	
March	12747	48.2		3842	36.4		3905	179.3	
April	9985	45.6		7221	35.9		2764	154.6	
May	13705	61.8		10432	51.9		3273	177.6	
June	27705	105.2		20463	84.9		7242	324.4	
Total	132408	47.6		94305	36.9		38103	169.4	

Source: Medical Statistics Division, Office of The Surgeon General,
War Department, Washington, D.C.

Table 8

Venereal Diseases
European Theater of Operations, U. S. Army
Cases and rates per 1000 strength per annum
by Clinical Forms by Years
February 1942 to June 1945, inclusive

DISEASE	Total		1942		1943		1944		1945	
	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate
Syphilis	21929	6.9	420	5.8	2798	10.6	8269	5.6	10442	7.6
Gonorrhea	119780	37.7	2196	30.2	7945	30.1	41824	28.4	67815	49.5
Other	6886	2.2	119	1.7	601	2.3	1525	1.0	4641	3.4
TOTAL	148595	46.7	2735	37.7	11344	43.0	51618	35.0	82898	60.5

Source: Medical Statistics Division, Office of The Surgeon General, War Department,
Washington, D.C.

Table 9

Syphilis
European Theater of Operations, U. S. Army
Cases and Rates per 1000 strength per annum, by months
February 1942 to June 1945, Inclusive

MONTH	TOTAL		1942		1943		1944		1945	
	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate
January	2067	7.7			112	10.2	567	9.2	1388	7.1
February	2096	7.4	1	3.2	50	5.9	606	8.6	1439	7.0
March	2714	7.2	3	3.8	32	3.9	738	7.1	1941	7.3
April	2230	6.9	2	2.3	105	9.9	687	7.4	1436	6.6
May	2390	7.2	9	4.2	104	11.0	613	6.1	1664	7.5
June	3308	8.1	8	2.3	86	7.1	640	5.0	2574	9.8
July	706	5.3	28	4.4	220	11.5	458	4.2		
August	796	5.1	59	6.7	295	15.2	442	3.5		
September	1034	5.2	47	3.7	337	14.4	650	4.0		
October	1245	6.5	107	6.4	401	10.9	737	5.3		
November	1317	6.4	96	8.6	395	9.6	826	5.4		
December	2026	6.7	60	6.4	661	10.2	1305	5.8		
TOTAL	21929	6.9	420	5.8	2798	10.6	8269	5.6	10442	7.6

Source: Medical Statistics Division, Office of The Surgeon General, War Department, Washington, D.C.

Table 10

Gonorrhea
European Theater of Operations, U. S. Army
Cases and Rates per 1000 strength per annum, by months
February 1942 to June 1945, Inclusive

MONTH	Total		1942		1943		1944		1945	
	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate
January	9396	35.0			512	46.8	1451	23.6	7433	37.9
February	9067	31.8	2	6.5	410	48.5	1428	20.3	7227	35.1
March	12103	32.1	11	13.9	378	45.6	1749	16.9	9965	37.7
April	10260	31.7	11	12.5	460	43.5	1646	17.7	8143	37.2
May	13464	40.4	29	13.6	322	34.1	1601	15.9	11512	52.0
June	26195	64.5	24	6.8	335	27.6	2301	18.1	23535	89.3
July	2594	19.3	103	16.1	627	32.8	1864	17.1		
August	2926	18.9	155	17.7	654	33.8	2117	16.7		
September	6128	30.7	450	35.5	730	31.3	4948	30.2		
October	8598	44.7	538	32.2	1043	28.5	7017	50.4		
November	7820	38.2	416	37.3	1051	25.7	6353	41.7		
December	11229	37.3	457	49.0	1423	21.9	9349	41.3		
TOTAL	119780	37.7	2196	30.2	7945	30.1	41824	28.4	67815	49.5

Source: Medical Statistics Division, Office of The Surgeon General,
War Department, Washington, D.C.

Table 11

Venereal Diseases, All Forms
By Theaters of Operations, U. S. Army
Rates per 1000 strength per annum by years
January 1942 to June 1945, inclusive

THEATER	Total	January 1942 to June 1945 inclusive			All Venereal Diseases				
		Gonorrhea	Syphilis	Other	1942	1943	1944	1945	
Total Army	37	27.6	5.5	3.9	38	28	37	52	
Continental U. S.	33	26.0	4.8	1.9	39	26	33	44	
Total Overseas	44	30.4	6.6	7.2	33	34	41	57	
Mediterranean	31	54.9	12.4	23.2	35	56	111	102	
Africa Middle East	67	29.0	13.6	24.7	86	69	60	75	
Latin America	54	31.7	10.1	12.1	74	58	36	27	
China-Burma-India	50	22.7	11.5	15.8	64	53	51	47	
European	47	37.7	6.9	2.2	38	43	35	61	
South West Pacific	26	17.0	3.1	5.4	33	15	7	57	
North America	12	10.0	1.5	.4	10	10	14	18	
Alaska	5	3.8	.8	.1	7	3	5	9	
Pacific Ocean Area	6	4.3	1.2	.3	11	5	5	3	

Source: Medical Statistics Division, Office of The Surgeon General, War Department,
Washington, D. C.

FIGURES

1. Physicians consider the problem of venereal disease control, Medical Field Service School, England, 1943.
2. London means Picadilly.
3. The British public house, colloquially "pub" was the soldier's club as well as that of the common man of Britain.
4. The GI finds Britain to his liking.
5. France welcomes America.
6. Towns were placed "off limits" as soon as occupied, St. Michel, France, 1944.
7. The small town cafes welcome American soldiers, Littry, France, July 1944.
8. The Paris boulevards were the center of all GI ambitions for leave,
9. Athletic contests were fostered as a form of substitutive activity, 10th Armored Division, Garmisch-Partenkuchen, Germany, June 1945.
10. A house of prostitution in Liege, Belgium, is placed "off limits" to U. S. troops, October 1944.
11. Fraternization "verboten" for 101st Airborne Division soldiers, Königsee, Germany, June 1945.
12. A soldier of the 42nd Infantry Division and his girl stroll through Vienna woods, June 1945.
13. Venereal diseases, all forms, European Theater of Operations, U. S. Army, by Major Commands in Great Britain, 1 January 1943 to 30 June 1944 and on the Continent, September 1944 to 29 June 1945, rates per 1000 strength per annum, by weeks.
14. Venereal diseases, all forms, European Theater of Operations, U. S. Army, base sections of the Services of Supply in United Kingdom, rate per 1000 strength per annum, by weeks, 1 January 1943 to 30 June 1944, inclusive.

15. Venereal diseases, all forms, European Theater of Operations, U. S. Army, base sections of the Communications Zone in Continental Europe, rates per 1000 strength per annum by weeks, 1 September 1944 to 9 June 1945, inclusive.
16. Venereal diseases, all forms, European Theater of Operations, Air Force in United Kingdom and on the Continent, rates per 1000 strength per annum by weeks, 1 September 1944 to 29 June 1945.
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2. Venereal diseases, all forms, European Theater of Operations, U.S. Army, Base Sections of the Services of Supply in United Kingdom, rate per 1000 strength per annum, by weeks, 1 January 1943 to 30 June 1944, inclusive.
3. Venereal diseases, all forms, European Theater of Operations U.S. Army, Base Sections of the Communications Zone in Continental Europe, rates per 1000 strength per annum, by weeks, 1 September 1944 to 29 June 1945, inclusive.
4. Venereal diseases, all forms, European Theater of Operations, Air Forces in United Kingdom and on the Continent, rates per 1000 strength per annum, by weeks, 1 September 1944 to 29 June 1945, inclusive.
5. Venereal diseases, all forms, European Theater of Operations, U.S. Army, Armies in Continental Europe, rates per 1000 strength per annum, by weeks, 1 September 1944 to 29 June 1945, inclusive.
6. Venereal diseases, all forms, European Theater of Operations, U. S. Army, United Kingdom and Continent, cases and rates per 1000 strength per annum by months, September 1944 to June 1945, inclusive.
7. Venereal diseases, all forms, European Theater of Operations, U. S. Army, colored and white, cases and rates per 1000 strength per annum, by months, February 1944 to June 1945, inclusive.
8. Venereal diseases, European Theater of Operations, U. S. Army, cases and rates per 1000 strength per annum, by clinical forms and years, February 1942 to June 1945, inclusive.
9. Syphilis, European Theater of Operations, U. S. Army, cases and rates per 1000 strength per annum, by months, February 1942 to June 1945, inclusive.

10. Gonorrhea, European Theater of Operations, U. S. Army, cases and rates per 1000 strength per annum, by months, February 1942 to June 1945, inclusive.
11. Venereal diseases, all forms, by theaters of operations, U. S. Army, rates per 1000 strength, per annum, by years, January 1942 to June 1945, inclusive.

A HISTORY OF PREVENTIVE MEDICINE
IN THE
EUROPEAN THEATER OF OPERATIONS
UNITED STATES ARMY
1941 - 1945

Part VI - Medical Intelligence

by

Colonel John E. Gordon, M.C.

Chief of the Division of Preventive Medicine

Office of the Chief Surgeon, ETO

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PART VI

Medical Intelligence

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Part VI

Medical Intelligence

Actual work in this particular field of preventive medicine was limited to the staff of the central division at theater headquarters. However, the material that was collected had wide circulation and use in the various branches of the Division of Preventive Medicine, in the several divisions of the Office of the Chief Surgeon, and in numerous instances by surgeons of other echelons. The primary objective was to secure data and make available current information on the movement and behavior of the communicable diseases. In addition, information was gathered on various other features of preventive medicine; on nutrition, venereal disease, and environmental sanitation. Types of organization and the quality of medical care furnished military and civilian populations of enemy countries were subsidiary interests. These ends were sought through contact with representative British research institutions, through attendance on scientific meetings and committee conferences, and through continuing familiarity with current medical literature. Contributions to medical research and especially the development of improved methods in preventive medicine were investigated and evaluated.

Functions and Policies.--While medical intelligence, strictly speaking, relates only to medical material bearing on enemy or enemy occupied territories, the work of the branch included similar interests in Great Britain, as a medium for improved practice in the work of the division both in its epidemiological activities and in military planning. The functions and policies to govern work in medical intelligence were defined as follows:

1. To acquire information and specific data on communicable diseases in countries or areas where the United States Army has, or anticipates having, close contact or relationship; and to make such information available to responsible officers of United States and allied forces.
2. To assemble the fullest possible information on methods, studies and projected developments in biologic warfare.
3. To collect information, study and analyze the provisions for medical care and the sanitary conditions, procedures and needs of American and allied troops and of civilian populations in countries to which American military operations are likely to extend.

4. To effect liaison with military and civilian organizations or persons of countries in which our troops may be located, in respect to suggestions bearing directly upon health and sanitary conditions.

Source of Materials.--Information on communicable diseases was obtained primarily from the Weekly Return of Infectious Diseases published by the British Ministry of Health; from the weekly Record of Infectious Diseases of Ports and other Localities at Home or Abroad, Ministry of Health; from the weekly bulletin of infectious diseases of the North Midland region, the weekly returns of cases of infectious disease notified in Scotland, and the weekly return of cases of infectious disease notified in North Ireland. Much worthwhile information came from the monthly bulletin of the Emergency Public Health Laboratory Service and from the monthly summary of Information on Typhus and other Important Epidemic Diseases in Europe, both issued by the Ministry of Health. Other more general information came from the registrar general's Weekly and Quarterly Reports of Births and Deaths in Great Britain. Perhaps as valuable information as any arose from personal contacts and through various committees of the Medical Research Council and other British medical and scientific societies. The meetings of advisory councils and special committees of the three British military services were particularly informative. No small amount of information came from interviews with allied military personnel returned from their native countries.

Specific information on how a currently existing disease was affecting enemy troops often proved of value in directing our own attack on the problem. To that end, frequent use was made of the help to be derived from the intelligence officers of Field Armies in the course of the interview and examination of recently captured prisoners of war. Examples of such interest were the frequency in the German army of trench fever, louse infestation, trench foot, and typhus fever, and the methods used for their prevention and control. (Fig. 1)

At least three other American agencies in the theater were engaged in the collection of medical information as it related to our allies and to the enemy. All three had a representative detailed for this particular purpose; and assistant medical military attache at the American Embassy; the permanent representative of the Office of Scientific Research and Development; and an officer of the United States Navy. Like good newspaper men--for work in medical intelligence resembles the practice of that



Figure 1.

Soldiers of the VIII Corps, U. S. Army, interrogate German prisoners of war in the Neuchateau-Bastogne sector, January 1945. Information was obtained on the prevalence of influenza, trench fever and trench foot.

profession--the various workers in the field held frequent meetings and conferences on matters of common interest. There was free exchange of information.

Activities.--Two continuing reports were prepared by the Medical Intelligence Branch. The first was a general weekly summary of information on infectious diseases, exclusive of experience in the European Theater of Operations, prepared from all available sources and submitted to the Chief Surgeon. The second was a weekly summary of the trend of the communicable diseases in the European Theater of Operations, with attack rates for the more important conditions and including illustrations, graphs, and charts representative of both civilian and military experience.

So much of the work that enters into medical intelligence has to do with the collection and analysis of statistical information--the records of what others are doing and have done--that it is not a particularly stimulating activity, nor does it give opportunity for much creative effort. It does demand continued and sustained interest. There is no question of its being essential to logical planning of future military operations in countries not too well known. The reasonableness of an attack on an epidemiologic problem often depends in considerable degree on how soundly the proposed measures are based on the particular conditions to be met and the past history of similar events.

The outstanding interest is in the interpretation of the information that is collected. What is the bit of critical information within the mass of irrelevant? What is the reliability of the source? What is the relative authority of the several statements on a single subject?

Medical Intelligence also had its lighter side, and some of the problems presented served to bring out all the elements of the best detective thriller. Reports intercepted in 1943 showed that two and a half train loads of live tortoises had recently been shipped from Bulgaria into Germany. With the limited rolling stock available to the Nazis and the pressure on transport which was as great with them as it was with us, why did the Germans have this urgent need for a quarter of a million live tortoises? If intended for food, why were they shipped alive, for there is certainly much wastage of shipping space in transport of a live tortoise. If intended for biologic experiment, why the huge number? If for manufacture of some biologic preparation, or testing of some chemical product, what could it be? The affair of the tortoises remained one of the unsolved mysteries of the war.

Transfer to Operations Division.--The Chief Surgeon initiated plans in 1943 for broadening the program in medical intelligence beyond the limits which had been defined and to an extent measurably beyond the interests of preventive medicine. These plans included consideration of conditions in enemy countries related to medical education, to research in a number of subjects allied to medicine, to medical supply and equipment, to the organization of medical and health facilities in enemy armed forces, and to the manufacture of drugs and biologicals. Because of this enlarged scope of activities, the Chief Surgeon transferred formal work in medical intelligence to the Operations Division of the Office of the Chief Surgeon on 6 November 1943.

Those features of medical intelligence which related primarily to epidemic diseases, and to preventive medicine problems in the areas occupied by American forces were continued as an obligation of the Division of Preventive Medicine, through delegation or that interest to the Epidemiology Branch of the office.

Throughout the subsequent existence of the Military Intelligence Branch under the Operations Division, there was continued and close cooperation by Preventive Medicine, particularly on the exchange of information on the communicable diseases. The Medical Intelligence Branch devoted much effort to assembling information on biologic warfare. This material was of great aid to the Chief of Preventive Medicine in the discharge of his duties as representative of the Chief Surgeon in that field. As military operations extended into Germany, a number of mutual interests led to collaboration in field studies. Those of more strictly professional interest included the preparation of typhus vaccine by German laboratories, epidemic hepatitis and the control of German biological laboratories. Others involved the evaluation of medical and scientific institutions, and of German medical education.

Personnel.--The Medical Intelligence Branch was under the direction of Captain Joseph T. Marshall, M.C., assisted by 2nd Lieutenant (later Captain) Edna M. Cree, A.N.C.

FIGURE

1. Soldiers of the VIII Corps, U. S. Army, interrogate German prisoners of war in the Neuchateau-Bastogne sector, January 1945. Information was obtained on the prevalence of influenza, trench fever and trench foot.

A HISTORY OF PREVENTIVE MEDICINE
IN THE
EUROPEAN THEATER OF OPERATIONS
UNITED STATES ARMY
1941 - 1945

Part VII - Laboratory Service

by

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Part VII

Laboratory Service

A comprehensive laboratory service designed to meet the needs of the Medical Department in a theater of operations has three principal obligations. The first is to provide a good service in clinical pathology, in order that hospitals of the theater may be assured the diagnostic aids so essential to good medical practice.

Secondly, laboratory facilities are necessary in support of the program in preventive medicine. In addition to the ordinary public health laboratory methods which enter into every day conduct of work in sanitation--the examination of water, food, and dairy products--provision must exist for the more highly specialized examinations which complete a well-rounded epidemiologic study.

The third essential is a strong central control laboratory with superior staff and equipment. Aside from a primary obligation to guide the choice of technical procedures by unit laboratories and to evaluate their performance, the duties of a central laboratory include responsibility for the many intricate examinations beyond the capacity of hospital or other diagnostic laboratories. Research, study and investigation of medical problems closely concerned with military operations constitute an additional function. Finally, certain laboratory services are best accomplished on a theater basis, either because of the special training required in their performance, or because they are particularly susceptible to examination in mass numbers, or because of the need for complicated apparatus.

In addition to what may be termed the professional requirements of a good laboratory service, certain administrative considerations have an important influence on its ultimate usefulness. The quality of the services provided--of methods, procedures, and performance, both diagnostic and public health--must be assured through periodic consultation with staffs and supervision of the activities of unit laboratories.

Laboratories must furthermore be so spaced geographically that ordinary diagnostic and public health laboratory service is readily available to most military units. Courier or other messenger service is needed to assure prompt service to all parts of the theater; in the dispatch of specimens and the return of reports between subsidiary laboratories and the central laboratory, and between units in the field and the local or central laboratory.

Policies and Functions.--While the general supervision of laboratory services of the theater was a responsibility delegated to the Division of Preventive Medicine in the Office of the Chief Surgeon, in actual practice it was a highly cooperative activity with the central control laboratory.

The general policies which involved broad application of the laboratory services to medical practice were formulated at theater headquarters. The criticism and advice on administrative and professional requirements contributed by the various divisions of the Office of The Chief Surgeon made for their practicability and usefulness. Regularly practiced review by the staff of the First Medical General Laboratory assured technical soundness. Actual supervision of laboratory practice in the field was more than a joint activity; it was largely contributed by the staff of the Medical General Laboratory.

The Laboratory Branch of the Division of Preventive Medicine, Office of the Chief Surgeon, operated according to the following scheduled functions: (1) The development and supervision of a comprehensive laboratory service for the theater. (2) Provision of consultation and aid to hospital and other laboratories of the theater in methods and policies. (3) Evaluation of the qualifications of laboratory personnel, with recommendations for their assignment. (4) Provision of assistance in epidemiologic investigations, through the Epidemiology Branch, to all units of command. (5) Cooperation with the Chemical Warfare Service in the control of industrial health hazards incident to that service.

Organization of the Service.--Three broad divisions of responsibility and of influence form the framework of a system meeting the requirements of a theater laboratory service as brought out in the foregoing discussion. The first is that of the central control laboratory.

The facilities of a central laboratory should be such as to provide the theater generally with the type of laboratory service which originates from the Army Medical School for the army as a whole. Certain supply functions fall within its obligations, particularly in respect to diagnostic reagents. It provides opportunities for the training and instruction of laboratory officers and technicians.

Throughout its existence, the European Theater of Operations had a functioning central laboratory that met these requirements. Its base of operations was in southern England, at Salisbury, Wilts. Because of the barriers of time and distance introduced by the extension of operations to the continent, a sub-central

laboratory was later established in Paris, France. It functioned more or less independently in providing central laboratory service to military units of that area, with the main laboratory in the United Kingdom Base continuing to provide consultation service and the more highly technical examinations. As troop strength and theater medical activities on the continent became progressively greater, these two laboratories exchanged places.

The second echelon of the theater laboratory service functioned on a regional basis. The laboratories providing the service were units of Medical Laboratory T/O 8-610 (Army or C.Z.). They were designed to meet the needs of large bodies of troops relatively far removed from central laboratory service. In actual practice, their location was determined as much on an organizational as a regional basis, since five of the seven in the European Theater were assigned to armies; and yet the arrangement was regional in that their obligations extended to all units within a given army area. One unit was in the Delta Base Section, and another acted as the sub-central laboratory in Paris, later in Great Britain. The medical laboratories gave a service somewhat less pretentious than that of the medical general laboratory although including most of the essentials, especially those of consultation and the investigation of epidemics.

The laboratories of hospitals constituted the third echelon of laboratory service. Both public health and diagnostic laboratory service was ordinarily extended to units in their vicinity, although such laboratories were designed primarily to serve the needs of the particular hospital of which they formed a part. Collectively they performed the great proportion of laboratory examinations for the theater, making most of the diagnostic examinations and a considerable part of those relating to public health and sanitary procedures.

Laboratory Facilities in the United Kingdom.--From the earliest days of its existence, the United States forces in the European area had adequate and satisfactory laboratory service. This came about through the circumstance that at the time war broke out in December 1941, an American laboratory with American equipment and personnel was working in Great Britain under the Ministry of Health. The American Red Cross--Harvard Field Hospital Unit had been established in 1940, for the purpose of contributing laboratory and epidemiologic service to British civilian and military installations. By good fortune, it was located almost in the center of that part of England which was to see the greatest concentration of American troops. The sponsors of the

unit, with agreement by the Ministry of Health, offered the facilities of the unit to the United States Army. It provided theater laboratory service and epidemiologic aid for the first eight months of military activities at a time when army facilities were decidedly limited. Most of the laboratory and field work incident to an extensive outbreak of homologous serum jaundice in the spring of 1942 was done by this organization.

Central Laboratory Service. --In accordance with an agreement made some months previously between the sponsors of the American Red Cross Harvard Unit, the Ministry of Health and the United States Army, this laboratory was activated as an integral part of the Medical Department in mid-summer, 16 July 1942. The staff was composed entirely of members of the original unit who volunteered for military service, and the entire plant and equipment at Salisbury was turned over to the army with the understanding that at the end of hostilities, it should revert to the Ministry of Health. As Medical General Laboratory A it operated as the central laboratory of the theater, performing the usual functions of a medical general laboratory. It was in full operation the day it was activated. Its first field epidemiological study for the army was undertaken within a week.

Fortunately, the demands for actual laboratory service at this time were not great because of the relatively small troop strength. This gave opportunity for planning and initiating the necessary changes to develop the facilities of the installation to the extent required for a theater of the size envisioned for ETO. On 23 July 1942, the Chief Surgeon directed that the plant be brought to a size sufficient to house a general medical laboratory. The first draft of building plans was completed on 3 August 1942 and by the middle of August specifications had been prepared for laboratory furniture and for necessary equipment and supplies. These plans provided added facilities for pathology; for water, milk and other sanitary examinations; for dental and veterinary sections, and a special section for virus and rickettsial studies. Facilities for preparation of media and cleaning of glassware were measurably increased. The need was met for greater housing accommodations, for more office space and for a teaching laboratory.

Major Ralph S. Muckenfuss took command of General Medical Laboratory A on 9 November 1942. Under his direction building operations gained new impetus, and eventually by the spring of 1943 alteration of existing buildings had been completed, new buildings were finished and furniture and equipment had been installed for their operation. With certain additions to its staff to meet the increasing needs of the developing theater, Medical General Laboratory A

continued to provide central laboratory service until the arrival of the First Medical General Laboratory on 7 June 1943, at which time that unit occupied the Salisbury laboratories, and supplanted Medical General Laboratory A. The latter was disbanded 25 June 1943. A number of its personnel were added to the complement of the First Medical General Laboratory, while others were directed to new assignments.

The First Medical General Laboratory was ordered into active military service at Camp Rucker, Alabama, on 15 June 1942 and arrived in Great Britain on 3 June 1943. Four days later it assumed its new duties as the central laboratory for the European theater, and continued in that capacity until 7 June 1945. (Fig. 1)

The general policies under which it functioned were:

- (1) All specimens from autopsies both gross and in fixatives to be sent to the central laboratory, with autopsy reports and summary of clinical record. The laboratory will complete the necessary examinations and forward all material to the curator of the army medical museum.
- (2) Specimens are accepted from laboratories when confirmation, identification or special examinations beyond the resources of the local laboratories are required.
- (3) Specimens of medico-legal importance, to include all instances of suicide or homicide, are to be sent to the general laboratory.
- (4) Assistance will be provided local laboratories when demands of a temporary nature exceed their facilities.
- (5) Assistance will be given in epidemiologic investigations on request of the Division of Preventive Medicine, Office of The Chief Surgeon, and through that office to all units of the command.
- (6) Assistance is to be given in unusual problems requiring the resources of a general medical laboratory.
- (7) The general laboratory will act as the central food control laboratory of the theater, in cooperation with the Quartermaster Corps.
- (8) Laboratory aid will be furnished the Chemical Warfare Service in the control of industrial health hazards incident to activities of that service.
- (9) Research will be undertaken on medical and sanitary problems intimately associated with the work of the theater.
- (10) Instruction and training is offered to laboratory and sanitary personnel.

During its long tour of duty in Great Britain, the First Medical General Laboratory provided a superior quality of laboratory service, contributed materially to the work of the various units of the Medical Department, and was the center of research and investigation. (Fig. 2) Eventually the changing character of the theater and the overwhelming preponderance of troops on the continent made advisable its transfer to a location where it could enter more intimately into the medical work of the theater. Accordingly it moved 29 March 1945 from its familiar location in

Salisbury, Great Britain, to new quarters in Paris.

The same situation which made necessary a central type of laboratory service both in the United Kingdom and on the continent still held good when the First General Medical Laboratory moved to Paris. To meet this requirement, the 361st Medical Composite Detachment (Laboratory) which had been furnishing similar services on the continent exchanged places with the First Medical General Laboratory, and commenced operations at Salisbury 12 April 1945. Reorganized as the 361st Medical Laboratory, it continued there until 31 July 1945, at which time central laboratory service in the United Kingdom ceased.

Regional Laboratory Service.--A number of Medical Laboratories, army type, were stationed temporarily in Great Britain in the course of preparations for invasion of the continent by the armies to which they were assigned. Their activities were limited to planning and training, and throughout operations in the United Kingdom there was no regional laboratory service. The First Medical General Laboratory provided the consultation and special services ordinarily demanded from both first and second echelons, an arrangement made possible by the relatively limited territory within which troops were stationed.

Unit Laboratories.--The first hospital laboratory to take up duties in the European Theater was that of the 10th Station Hospital at Londonderry, North Ireland, 24 January 1942. It was joined that spring by the laboratory of the 5th General Hospital, which located at Belfast. In the next several months new hospitals with their laboratories continued to arrive in the British Isles, so that at the end of 1942 there was a total of 10, five of which were general hospital laboratories. (Fig. 3)

At the end of 1943 the number of American hospital laboratories was 50, of which 15 were general hospital laboratories. The number in 1944 was 102, with 72 at general hospitals; and when activities ceased in June 1945, the total number of hospital laboratories operating in Great Britain was 39, of which 30 were in general hospitals. The numbers cited apply only to hospitals and their laboratories which were actively in operation. Units that were staging are not included. Almost without exception the laboratories were connected with either general or station hospitals. The few evacuation hospitals in Great Britain functioned irregularly and usually were only staging for future continental operations. The geographical location of hospitals was so arranged as to provide adequate medical care for all troops within the theater area.



Figure 1.

First Medical General Laboratory, Salisbury, England



Figure 2.

Bacteriological Laboratory at First Medical
General Laboratory.



Figure 3.

Laboratory of the 2nd General Hospital, Oxford, England.

Consequently, no field unit within the United Kingdom was far removed from a source of satisfactory local laboratory service. (Fig. 4)

As hospital centers came into being in Great Britain in late 1944 and 1945, an arrangement developed that corresponded in a way to second echelon laboratory service such as that provided by Medical Laboratories. Hospital centers were formed from varying numbers of General Hospitals.

These were ordinarily of a superior type, with well equipped and well staffed laboratories. The laboratory work of a center was under the direction of a laboratory co-ordinator, and it was common practice for one hospital laboratory to take responsibility for a particular feature of the work, such as pathology, another for serology, and a third for chemistry. As a result, a superior type of service was developed and became available to units of the surrounding area.

While the United States Army had a comprehensive and competent laboratory service in the British Isles, it was not all inclusive. On many occasions and particularly in the earlier days of the theater, the United States forces were indebted to various British laboratories of universities and scientific institutes for material aid in special situations, and for certain types of examinations beyond the capacity of even the best field laboratories.

When American hospital laboratories were limited in number in 1942 and 1943, the Emergency Public Health Laboratory Service of Great Britain placed the full facilities of its central and constituent laboratories at the service of the United States Army. These laboratories were widely distributed throughout England, were freely used and were of decided help in the formative days of the theater.

Laboratory Service in Continental Operations.--In conjunction with the Hospitalization Division of the Office of The Chief Surgeon, plans were initiated in July 1943 for the laboratories of hospitals intended to serve with the Communications Zone in France. These were general and station hospitals. Specifications were provided for space, lighting, electrical outlets, and other technical features suitable to both tented and hutted accommodations. Decision was also taken to provide a separate central laboratory for the continent. The initial requirements were to be met by a small separate detachment of the First Medical

General Laboratory.

Central Laboratory Service.--A detachment of six officers and twelve enlisted men from the First Medical General Laboratory arrived in LeMans, France, on 19 August 1944. Laboratory space, rations, and quarters were provided by the 19th General Hospital. The first laboratory specimen was examined 21 August 1944.

The laboratory service in common with the theater generally, encountered many difficulties at this time because of the rapidly changing military situation, the lack of communications and uncertainties in supply. Order started to come out of the wild rush across France when the headquarters of the Communications Zone were established in Paris in early September. Early consideration was given to an improved laboratory service. Paris was unquestionably the best place for a central laboratory. The communication system of France centers about that city, and better service could be anticipated in the receipt of specimens and the transmission of reports. There was the further desirable feature of having the laboratory near headquarters.

By arrangement with the commanding officer of the 108th General Hospital, Paris, commodious quarters were furnished the laboratory detachment in the former Beaujon Hospital, one of the modern medical institutions of Paris. Within weeks the detachment was providing a very satisfactory service. The volume of work increased as the location of the laboratory became known, and as communications improved. By October, most of the special services ordinarily provided by the parent laboratory were being accomplished by this small hard-working detachment. Improved cross-channel communications furthered the transfer of special materials between the detachment and the central laboratory in Salisbury.

Eventually, the demands for laboratory service exceeded both the facilities at Beaujon and the capacities of the modest detachment. The 361st Medical Composite Detachment (Laboratory), a unit comparable in size and equipment to an Army Medical Laboratory, was therefor assigned to this duty. The detachment of the First Medical General Laboratory continued to work with them, however, until 30 October 1944. The laboratory itself was transferred on 16 December 1944 from the 108th General Hospital to the Institut Pasteur, where it occupied the third floor of the main building, with parts of the first floor, and additional storage space.

By the end of 1944 it became apparent that the First Medical General Laboratory could not continue indefinitely to give adequate service to the theater from its location in England. The



Figure 4.
Distribution of Hospital Laboratories in the United Kingdom, 31 December 1944.

English Channel constituted an obstacle to communications and to the rapid transmission of specimens and reports to an extent seriously impairing the usefulness of laboratory examinations. Furthermore, personal consultation on laboratory problems was almost impossible. Plans were therefor made to move to the continent.

The quarters at the Pasteur Institute were too small to accommodate a medical general laboratory. As a result of search for other facilities in Paris, arrangements were eventually made for the laboratory to take over unfinished quarters at the Faculte de Pharmacie, University of Paris. The French contractors who had started construction of these new laboratories just before the war, agreed to complete the building operations. The work suffered the usual wartime delays. Consequently, when the First Medical General Laboratory arrived in Paris on 27 March 1945 to relieve the 361st Medical Composite Detachment (Laboratory) it was compelled to take over the quarters in the Pasteur Institute then occupied by that organization. Not until the latter part of May did the first sections of the laboratory move into their new quarters at the School of Pharmacie, and the transfer was not completed until 1 June 1945. By that time the First Medical General Laboratory had received orders for redeployment to the Pacific Theater. After a tenure of six days they turned over responsibility to the Fourth Medical Laboratory. This unit continued the services of the central theater laboratory until the activities of ETO ceased on June 30, 1945.

Regional Laboratory Service.--Each army of the Ground Forces had its own Medical Laboratory (Army or Communications Zone type), a standard unit of the United States Army which included eleven officers and forty-seven enlisted men. These laboratories served the combat troops, and the hospitals attached to armies. (Fig. 4) They supported the preventive medicine services of armies through an active epidemiologic service.

Army laboratories had the same privileges in respect to the facilities of the central laboratory as did all other organizations of the theater; for special examinations beyond the capacity of their equipment or staff, for consultation on technical problems, and for checking of results. Epidemiological consultation and field aid were likewise furnished to all of the army laboratories by members of the staff of preventive medicine at theater headquarters, and by the medical general laboratory.

The first laboratory to take part in continental operations was the Tenth Medical Laboratory. It served with the First

United States Army, landing on Omaha Beach, Normandy, on D plus 11, 17 June 1944. Organizational equipment was found in the various supply dumps on the beach, and on 29 June 1944, laboratory work began. (Fig. 5) Thereafter the laboratory moved over France with the First Army, into Eupen in Belgium, for a time in Luxembourg, and eventually into Germany.

As the other armies of the ground forces came into action, their laboratories also became operational. (Table 1) The history of all was of the same active service, and the same frequent shifts in base of operations. Their work was done in tents, in abandoned buildings, in schools, and sometimes but not often, in first class existing laboratories. (Fig. 6) The First, Third, and Seventh Armies had laboratories almost from the time they took the field, but service for the Ninth and the Fifteenth was delayed somewhat because of lack of available units.

The Fourth Army Laboratory was the only one of this type that served a Communications Zone unit, Delta Base Section. Regional laboratory service was necessary in this instance because of the geographic isolation of Delta Base Section, and because of the many special problems of the region requiring laboratory aid. The 361st Composite Medical Detachment (Laboratory) served for a time as the central laboratory on the continent, and later as the base laboratory in the United Kingdom.

Unit Laboratory Service.--Laboratory service at its basic level continued to be furnished to the Medical Department on the continent by the laboratories of hospitals, again primarily concerned with diagnostic work for the units of which they were a part, but nevertheless giving a considerable amount of aid in public health laboratory methods to other military installations contiguous to them. In the United Kingdom, only general and station hospitals participated in this service. They continued on the continent to provide the bulk of unit laboratory service; but there was additional help from the laboratories of evacuation hospitals, located almost exclusively in army areas and with armies, and to a certain extent from the laboratories of field hospitals. (Fig. 7) The latter had no laboratory officer but did have provision for the simpler laboratory examinations. They were commonly located well forward where they were particularly useful, because regular service was far removed. Unit laboratory service on the continent was liberally provided and almost invariably available within a reasonable distance. (Fig. 8) At the end of 1944, 99 hospital laboratories were in operation, of which 43 were in general hospitals, 14 in station hospitals, and 42 at evacuation hospitals. When operations ceased on 30 June 1945, the number of unit laboratories functioning on the continent



Figure 5.

10th Army Medical Laboratory, Normandy, France



Figure 6.

Laboratory of clinical pathology under field conditions,

10th Medical Laboratory, France.

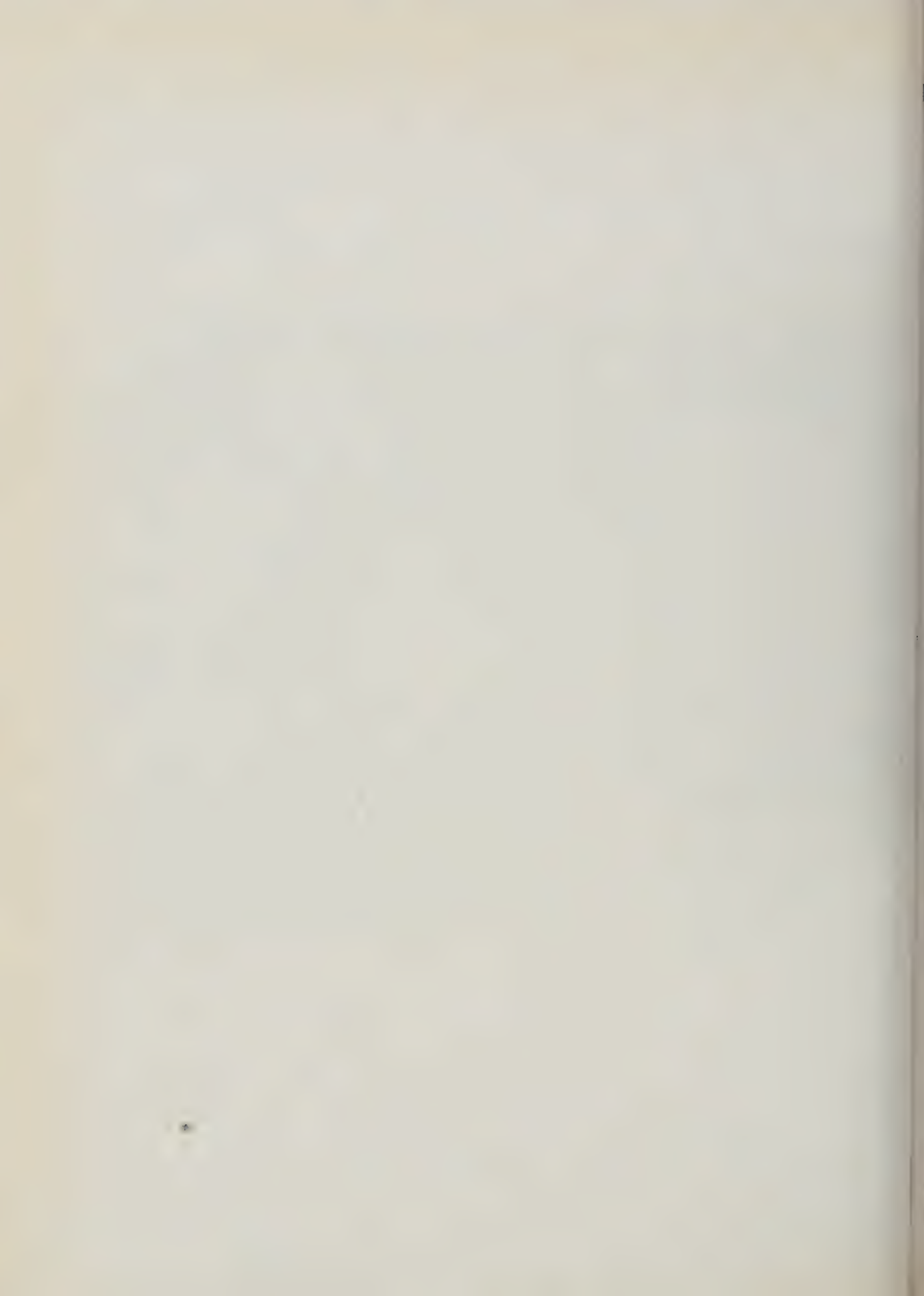




Figure 7.

Laboratory of the 48th Field Hospital, Germany



Figure 8.

Distribution of Hospital Laboratories in Continental Europe, 31 December 1944.

was 112, with a distribution of 56 general, 18 station, and 48 evacuation hospital laboratories. Evacuation hospitals made frequent moves. The numbers listed show those operational on the dates given although a few were in all probability in course of transferring locations and not actually receiving patients or providing laboratory service. In addition to hospital laboratories, general dispensaries and the convalescent hospitals of armies provided a certain additional amount of laboratory service.

Other Laboratory Service.--French and Belgian civilian laboratories were not used by the American forces to the extent that had held for the United Kingdom, primarily because installations in the areas of greatest troop concentration had suffered greatly from the war and lacked their usual facilities; and also because there was less need. The Army in France was liberally supplied with laboratories. Special mention, however, is deservedly made of the Institut Pasteur of Paris, which not only housed the United States Central Laboratory for many months, but throughout the course of operations made available the special technical facilities of that famous institution, and gave liberal aid in consultation.

Supervision of the Laboratory Services.--Experience during the early months of the theater served to bring out the considerable variety of training and experience among the various directors and staffs of hospital laboratories. Decision was therefor taken in late 1942 to institute a general inspection of all laboratories of the theater, with the purpose of determining their ability to take a proper place in provisions for the care of patients.

This objective could presumably have been accomplished by various members of the preventive medicine staff at headquarters in the course of their general supervisory duties throughout the Services of Supply; or it could be made a special activity of some one or more individuals particularly skilled in laboratory work and actually engaged in laboratory practice. The latter arrangement promised greater usefulness and exactness. The commanding officer of the First Medical General Laboratory agreed to accept the responsibility. The general scope of what was wanted, of methods of handling reports, and for action on recommendations were defined. The first inspections were made during the early months of 1943, in the course of which all laboratories of the theater were visited. A variety of factual information was acquired.

The value of such study and the recommendations for improvements in staff, equipment and service were such that the

the project was made a continuing activity. Major W. S. Spring of the laboratory staff was assigned to the work. A goodly proportion of his time was spent in actual field inspections. His headquarters were at the First Medical General Laboratory where he participated in courses of instruction for officers and technicians, bringing to this work the practical knowledge of common deficiencies and needs which came from actual contact with problems in the field. From time to time he was on temporary duty with the Division of Preventive Medicine at theater headquarters, facilitating action on various recommendations concerning supplies, equipment and personnel which arose from his observations. Other special inspections by members of the laboratory staff or of the Division of Preventive Medicine were made on occasion, such as the survey of laboratory service during the early days of continental operations, but in the main this activity was conducted in the manner indicated. It is to be recommended.

A trained specialist directly engaged in active laboratory work has an advantage in approach that comes from familiarity and sympathy with problems. He is likely to find more ready acceptance of the purposes of his visit than an administrative officer who too often has the inspector point of view. Admirable opportunity was likewise presented for effecting close liaison between unit laboratories and the central laboratory in respect to services which the latter was able to provide. This project continued an active interest throughout the life of the theater.

Detailed reports on each laboratory were made at the time of the original survey in 1943, and for all new units as they arrived in the theater. Particular effort was made to visit these newly arrived units as promptly as possible, in order to acquaint them with theater directives and the policies of the general laboratory program. Thereafter, at subsequent visits, note was made of the extent to which deficiencies in equipment or methods had been remedied, on changes in staff, and of special interest or problems of the laboratory or of the region in which it worked. A file was kept for each unit. Reports of inspections were submitted to the Division of Preventive Medicine for action through the appropriate division of the Office of the Chief Surgeon.

The subjects considered in the course of these inspections included problems of equipment, and of the training and experience of the staffs of laboratories, both officer and enlisted. Technical and administrative procedures were reviewed to the end of effecting improvements in the service provided. Information was obtained on the amount and character of public health laboratory work performed for units of the surrounding area. Finally common interests of unit and central laboratories were reviewed in respect to

consultation service, diagnostic reagents and other relationships, in an attempt to eliminate difficulties and inadequacies.

Professional Personnel of Laboratories.--Personnel matters affecting officers and men of laboratories received important attention in the course of laboratory inspections. In the United Kingdom the problems were those of an occasional change in assignment to remedy specific deficiencies of a laboratory. Most hospital laboratories arrived with well qualified and trained staffs. Later in the war, less time had been given to training and organization and fewer laboratory specialists were available. Adjustments were more frequently necessary.

Particular consideration was given to the needs of individuals for further training, or their desire for experience in special fields. The Medical General Laboratory organized comprehensive courses for both officers and men at the central laboratory. Opportunity for attendance came in large part from the recommendations of the laboratory inspector. In addition to formal courses, opportunity was given to laboratory workers with a special interest in some field or in some specific technic, to spend a week or two in the appropriate division of the general laboratory.

The great number of new hospitals requisitioned for the theater in 1944 and 1945 led to a situation where many arrived with staffs lacking chiefs of major services, of the laboratory rather frequently. These deficiencies were met by promoting those junior members of the staffs of existing laboratories who had demonstrated special aptitude and skill in the professional and administrative features of laboratory practice.

As a part of a general theater activity, the laboratory service made a study of the professional training and qualifications of officers in laboratories, not only of the medical corps but of all branches of the medical department. The analysis and subsequent classification were of profit in reassaying the performance of officers of the theater, and in bringing about indicated changes in assignment.

Special Topics.--No attempt will be made to set down the nature or the scope of those many details which enter into the conduct of a laboratory service at theater level; the requisition of some special piece of apparatus, shortages in authorized tables of equipment, personnel problems, or the administrative action required of unusual or particularly significant laboratory results. Certain problems attained importance because of difficulties presented in their solution, or because they led to establish-

ment of significant theater policy. From others came the development of special services, subsequently characterizing the work of the theater. Some were almost wholly administrative, others were of professional nature. They are presented in that order.

Food Laboratory.--A food control laboratory had been included in the original plans of the Quartermaster Corps. The First Medical General Laboratory of the Medical Department had likewise included staff, equipment, and facilities for the sanitary examination of food and dairy products. Concentration of the work in one organization had apparent advantages. By mutual agreement of the two services, the medical department accepted responsibility for all laboratory examinations in this field, and for the necessary consultation service to the Quartermaster Corps.

Laboratory Supplies and Reagents.--The laboratories of the London County Council had developed over a number of years a system of supplying bacteriologic culture media and reagents peculiarly adapted to the use of small laboratories and especially to military installations under field conditions. The materials are supplied ready-prepared in special type tubes. The needs of the British Army and Navy had been met from this source throughout the war. Arrangements were made for a similar service to the United States Army, with requisitions through ordinary supply channels of the U. S. Army Medical Department, but with shipment direct from the manufacturers. The service was prompt and the materials first-class. A similar system is recommended for the peace-time laboratories of the army and for future operations. The products are particularly adapted to laboratory chests of mobile laboratories.

Diagnostic reagents for bacteriologic examinations, such as agglutinating serums and antigens, are prepared by the Army Medical School. Their peculiar characteristics make distribution through regular medical channels unsatisfactory. The first Medical General Laboratory was designated the source of central supply for this class of materials, through direct requisition by unit laboratories.

Stock Bacteriologic Cultures.--Because of danger in working with certain cultures of bacteria, so great that they should not be handled at all unless justified by definite emergency, a policy was adopted that cultures of bacteria would not be furnished unit laboratories except to meet specific needs. Strains of brucella abortus, vibrio comma, and bacillus anthracis would not be furnished under any conditions, and would not be maintained by the central Medical Laboratory unless required by the most unusual circumstances.

License for Animal Experimentation. --The United Kingdom had stringent regulations that govern the use of experimental animals in laboratories. A specific license was required, applicable to specified laboratory premises which were subject to inspection, and an individual license must be held by each individual operator concerned with animal experimentation.

In the early days of the theater, permits were obtained in the prescribed manner from the British Home Office for staff members of the central laboratory, and for the few other laboratories where animal tests were essential. The changing character of operations and the greatly increased numbers of medical units, made an altered procedure necessary. Laboratories frequently moved from place to place and licenses were given for a fixed location. Changes of personnel were frequent under military conditions, and licenses were issued to particular individuals. Furthermore, it was believed sound principle that the United States Army should control its own operations. There would seem to be no more reason for a United States Laboratory to be subject to inspection by a civilian authority, than for an army mess to be under control of the local health officer. A number of conferences with officials of the British Home Office led to agreement that His Britannic Majesty's Government would waive the requirement for license and regulation for United States military forces, and that the United States Army would introduce a system of licensure incorporating the essential provisions of the British Cruelty to Animals Act of 1876. Thereafter, permits were issued to laboratory units and to individuals over the signature of the Chief Surgeon and the Chief of the Division of Preventive Medicine.

Messenger Service. --Because of the delays involved, the Army postal system proved wholly unsatisfactory for the transport of pathologic material and the return of reports. The GHQ Messenger Service was substituted through agreement with the Signal Corps. At least six different courier routes were operated. Transfer of material destined for the central laboratory from one route to another continued to give rise to delay, and the loss of materials was altogether too frequent. The courier service appreciated the problem; it entered equally into their other general activities. A series of conferences served to bring about an improved system. Special instructions were issued by the Medical Department to govern transport of medical materials. As experience increased and as the need for care in packing became appreciated, a fairly satisfactory courier service became available.

The same general courier system was used in operations on the continent. The history of the United Kingdom was repeated.

In the beginning the courier system was none too satisfactory, because of the common disorganization and difficulties in transportation. Gradually the service was brought into order, and in 1945 conditions could be said to be again good. This matter of rapid transport of materials and reports is one of the greatest difficulties to be surmounted in providing a usable laboratory service. The problem was never wholly solved in the European Theater. It remains a feature to be given needed attention in future plans for a theater of operations.

Technical Services of the Central Laboratory.--A circular letter of the Office of The Chief Surgeon, 10 October 1942, described the services in medical consultation available to the theater. It stated that the central laboratory was prepared to furnish aid and consultation to chiefs of laboratory service of general and station hospitals, and to surgeons of ground force and air force units on request. The laboratory was not designed to do routine examinations but would undertake the more special features of laboratory work beyond the facilities of smaller laboratories. The fields in which consultation was available were bacteriology, virus infections, clinical chemistry of blood and urine, and problems related to entomology and insect infestation. Subsequently, a number of command circulars and circular letters from the Chief Surgeon gave direction on specific features of laboratory practice. These were eventually brought together in November 1943, and the directive then issued continued to be the guide to the laboratory facilities and procedures available at the central laboratory.

Pathology Service.--A central service for pathology was one of the early developments. An order of 31 October 1942 directed that autopsy protocols and clinical records of all deaths of United States Army personnel were to be forwarded to the First Medical General Laboratory. It was desirable to include specimens of tissue for microscopical and gross examination. An acceptable form of autopsy protocol was outlined. Subsequently, the Medical General Laboratory was established as the histopathologic center for the theater. All tissues for examination originating from station hospitals were required to be sent to the central laboratory, while general hospitals retained the option of making their own examinations, or sending the material to the central laboratory. The purposes of establishing the histopathologic center were to eliminate the difficulties encountered in obtaining apparatus and to elevate professional standards. A service for examination of surgical and biopsy tissues came into being somewhat later. Special directions were given for the conservation and examination of ophthalmologic tissues.

The Army Medical school was in need of pathologic material of certain specified kinds. To facilitate its collection, and to more adequately care for the large amount of material that was accumulating in the course of the greatly increased medical activities of the theater, it was directed that all autopsy protocols and autopsy tissues for transmission to the Army Medical Museum should be forwarded through the First Medical General Laboratory.

Serologic Tests for Syphilis.--To meet observed deficiencies in the performance of serologic tests for syphilis, arising from performance of these examinations by smaller laboratories that lacked trained staff and equipment, it was directed in February of 1943 that all such examinations on blood serum should be performed in laboratories of general hospitals or of the central laboratory. All specimens of cerebrospinal fluid were to be examined by complement fixation and only at the central laboratory. On the recommendation of laboratory inspectors as to qualifications of staff and adequacy of equipment, the Chief Surgeon might designate other laboratories to perform these tests. Further provision was made for periodic inter-laboratory checks between the various laboratories of general hospitals and the Medical General Laboratory. Subsequently, information was circulated on the false positive serologic reactions observed in the course of non-syphilitic diseases, the conditions under which they occurred, the interpretation to be given, and the course to be followed in the management of patients. A further directive under date of 2 October 1943, incorporated the general features of previous orders and added a number of technical details. These included directions for uniform recording of results, and provision that all positive results obtained by the qualitative Kahn test on serums taken routinely or incident to a physical examination, should be checked by complement fixation.

Epidemiologic Service.--Almost no epidemiologic investigation is complete if it lacks the information furnished by laboratory examination of materials arising from the field of study. Field studies were ordinarily initiated by preventive medicine officers, or by unit surgeons. All laboratories of the theater have had a part in a number of such studies. Aside from purely laboratory contributions relatively few laboratories have failed to participate in some one or many actual field investigations, the Medical Laboratories attached to armies to a greater extent than others. The laboratory of the Fifth General Hospital made extensive investigations of homologous serum jaundice and of tuberculosis.

Epidemiologic consultation was a continuing function of the First Medical General Laboratory. In purely laboratory aspects this was almost a daily activity. Field studies were undertaken in problems of any intricacy or magnitude. A small station hospital operated in conjunction with the central laboratory provided hospital accommodation for the study of patients with communicable disease of unusual or indefinite nature, as encountered in the course of field studies or of other origin.

Research and Laboratory Investigation.--That special laboratory studies and research should be limited to problems of direct bearing on operational needs was early established as a general theater policy. Particularly complicated studies and those which promised to be of long duration, were to be referred to research institutions of the Zone of the Interior. This in no way inhibited the Medical General Laboratory in developing many research interests, in which most of the divisions of that organization participated. The sections devoted to the study of virus and rickettsial diseases, and to pathology were especially productive. Many of the results are incorporated in published papers. The specific record of accomplishment is to be found in the reports of the First Medical General Laboratory.

The commanding officer of the First Medical General Laboratory was appointed Director of Research for the theater and as such functioned as a member of the group of consultants in the Division of Professional Services of the Office of The Chief Surgeon. This served to facilitate the reference of problems which arose in the course of professional activities. The variety was great; they came sometimes from the air force, sometimes from the services of supply and sometimes from the ground forces. They were treated in a variety of ways. In many instances members of the central laboratory staff were assigned to further exploration of problems referred from field or clinic. In other instances, medical officers were detailed for temporary duty at the central laboratory, that they might investigate their own problems, with the facilities and equipment of that organization at their disposal.

Personnel.--The officers responsible for administration and supervision of the theater laboratory service came from two groups, those at theater headquarters in the Division of Preventive Medicine, and those associated with the staff of the First Medical General Laboratory.

At theater headquarters no one officer ever devoted full time to this interest until the latter days of the theater, when

Major W. S. Spring was transferred from the central laboratory to the Division of Preventive Medicine. General direction of activities was under the chief of the division, with principal assistance by a number of officers, ordinarily those associated with the Epidemiology Branch, including Captain Joseph T. Marshall, Lieutenant Lawrence Kilham and Lieutenant Colonel Richard Mason.

Supervision and inspection of unit laboratories of hospitals was accomplished almost entirely by the staff of the First Medical General Laboratory. The commanding officer, Colonel R. S. Muckenfuss took personal direction of this part of the work and made many of the inspections himself. Major W. S. Spring had this duty as his principal obligation. Some special problems had the attention of Lieutenant Colonel Murray Angevine and Lieutenant Colonel Joseph Smadel.

Summary.--So much depends on the human factor in laboratory work, that quality of service bears a direct relation to the training and aptitude of the men who provide it. The facilities they had to work with were in most instances adequate. It was surprising in the course of active field operations--and this relates particularly to the laboratories of Armies--how much good work came out of laboratories working in tents under most difficult conditions. Technical equipment was in general sufficient; indeed, it was decidedly good. The single outstanding suggestion for improvement of a theater laboratory service which comes from this experience, is of administrative rather than professional nature.

It would appear that if a central laboratory is to function to the fullest extent in the capacity for which it is designed, that the great bulk of routine work which fell to the First Medical General Laboratory in the European theater, should be eliminated. The major effort of a general laboratory should be devoted to specialized types of laboratory examinations; to consultation, and to field and laboratory research. It is believed that a central laboratory of such circumscribed responsibilities could meet its obligations with a staff whose numbers were essentially those of the present Medical or Army type Laboratory. Their training and experience should be that which generally characterize staffs of medical general laboratories. There can be disadvantage in too large an organization too permanently established. It should be able to move with less difficulty than the present general laboratory. Equipment and supplies should be commensurate with the mission--and therefor superior to those of the primarily diagnostic laboratory. The mobile sections of the Army Medical Laboratory, so well adapted to epidemiologic studies, should be a feature.

It is believed that all routine tests and most of the semi-specialized examinations could be handled to better advantage by an appropriate number of Medical Laboratories (Army or C.Z.) assigned on a regional basis to be determined by troop concentration and geographic area involved. In the ETO as it existed, two or at most three additional regional laboratories would have met all requirements. Under such an arrangement the average distance from unit installation or hospital laboratory to a laboratory of superior facilities would be materially less. It should make for more prompt service; the limitations imposed by transportation and courier services have already been stated. Regional laboratories would have a similar advantage in acting as sources of supply for laboratory reagents and in providing inspection and supervision of unit laboratories. The central laboratory, freed of these responsibilities, would be permitted full employment of its resources in the more highly technical services for which it was designed, and in a wider participation in field studies for the control of epidemics.

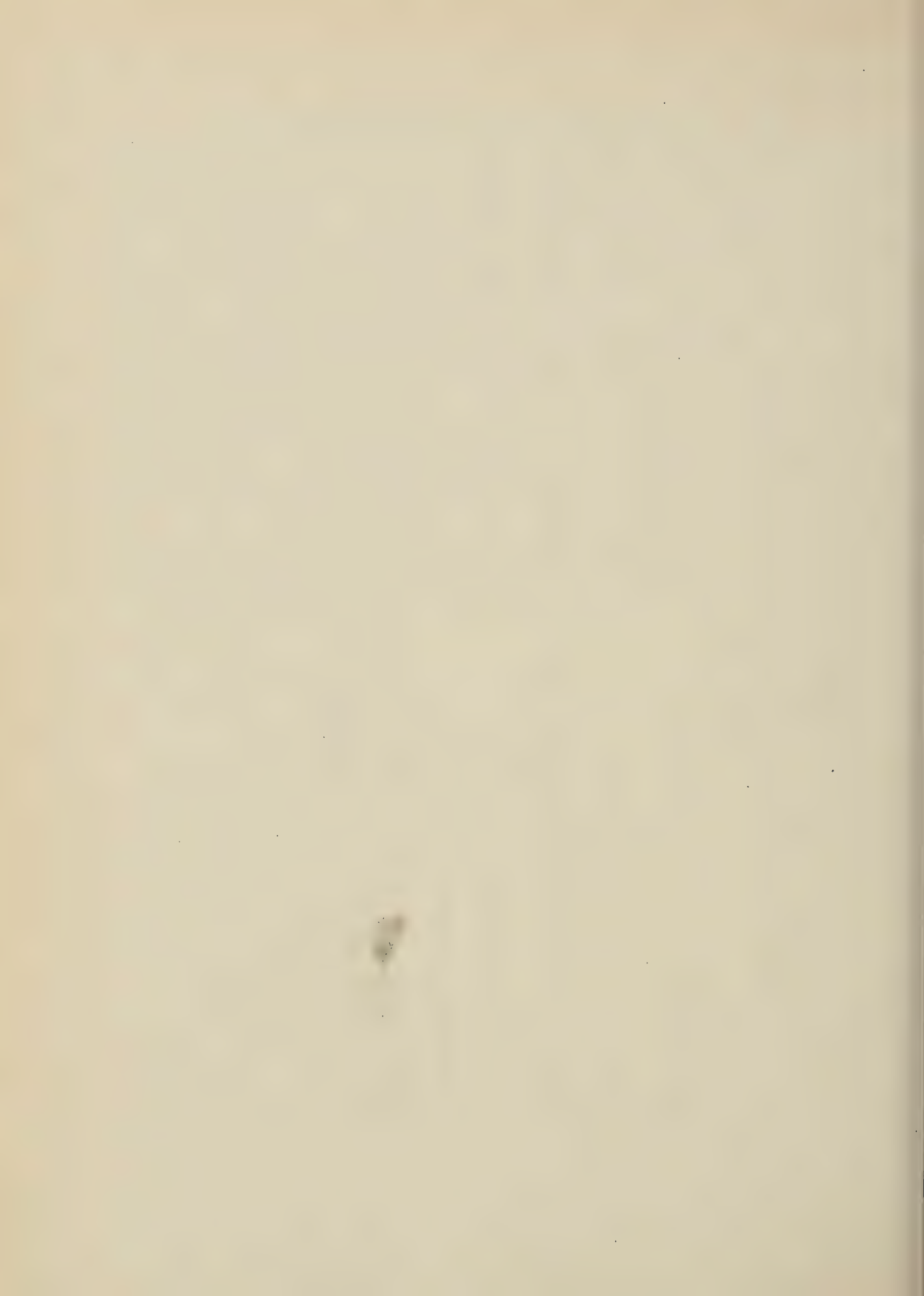
This is recommendation of a more decentralized laboratory service, to provide the Communications Zone and the Air Forces with the advantages which the Ground Forces alone had under the existing scheme.

TABLE I

ARMY MEDICAL LABORATORIES SERVING ON THE EUROPEAN CONTINENT

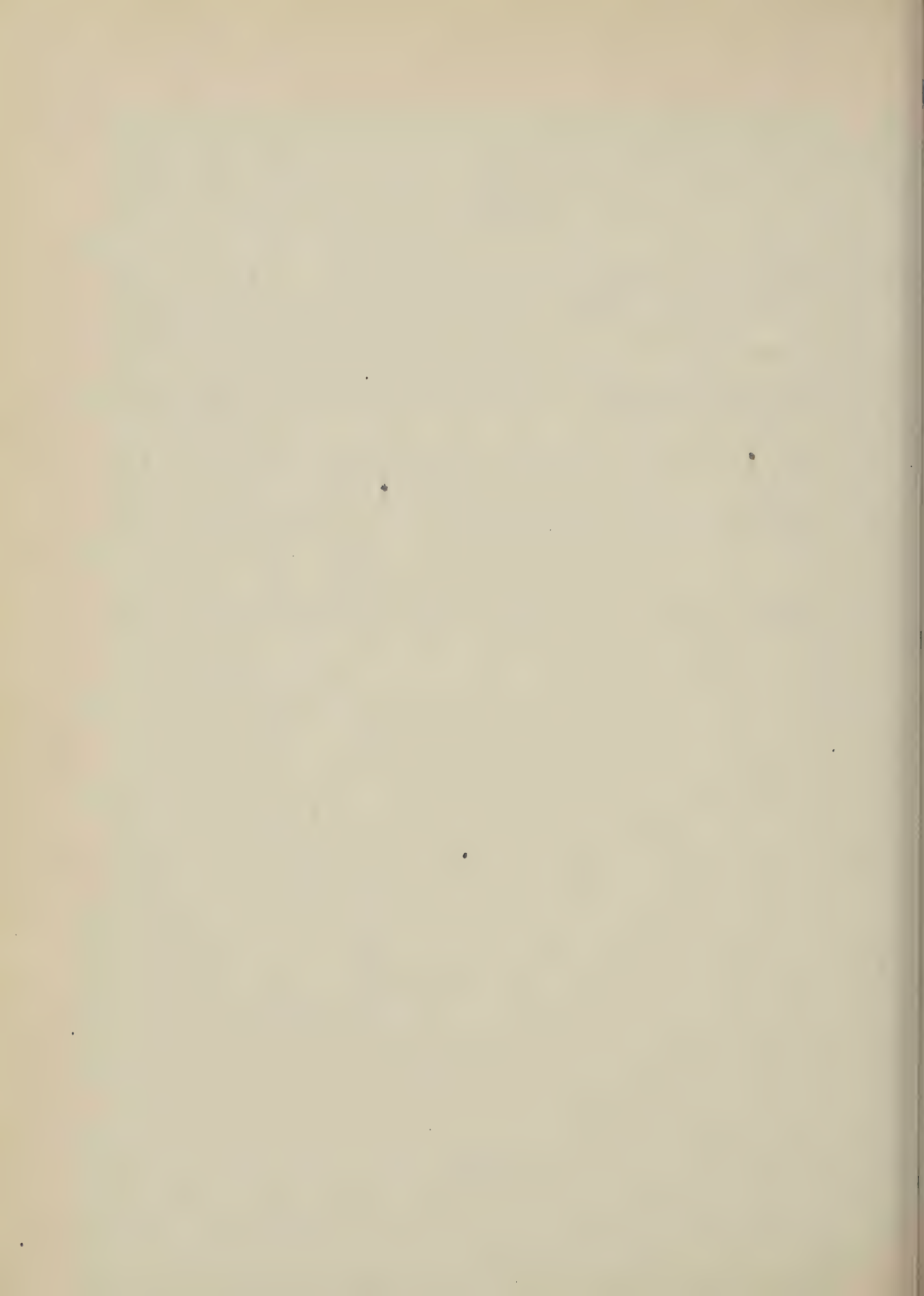
1944--1945

Name of Unit	Assignment	Date Becoming Operational	Date relieved
1st Medical Laboratory	Seventh Army	6 October 1944	On duty ETO 30 June 45
4th Medical Laboratory	Delta Base Section Central Lab.	9 September 1945	On duty ETO 30 June 45
7th Medical Laboratory	Third Army	1 August 1944	On duty ETO 30 June 45
10th Medical Laboratory	First Army	29 June 1944	10 June 1944
28th Medical Laboratory	Fifteenth Army	1 April 1945	3 June 1945
361st Medical Laboratory	Sub-central Theater Laboratory	2 October 1944	29 March 1945
362nd Medical Laboratory	Ninth Army	24 December 1945	30 May 1945



FIGURES

1. First Medical General Laboratory, Salisbury.
2. Bacteriological Laboratory at First Medical General Laboratory.
3. Laboratory at the 2nd General Hospital, Oxford, England.
4. Distribution of Hospital Laboratories in the United Kingdom, 31 December, 1944.
5. 10th Army Medical Laboratory, Normandy, France.
6. Laboratory of clinical pathology under field conditions, 10th Medical Laboratory, France.
7. Laboratory of the 48th Field Hospital, Germany.
8. Distribution of Hospital Laboratories in Continental Europe, 31 December, 1944.



TABLES

Table 1. Medical Laboratories, T/O and E 8-610, Serving in Continental Europe.

A HISTORY OF PREVENTIVE MEDICINE
IN THE
EUROPEAN THEATER OF OPERATIONS
UNITED STATES ARMY
1941 - 1945

Part VIII - Gas Casualties

By

Colonel John E. Gordon, M. C.

Chief of The Division of Preventive Medicine

Office of the Chief, Surgeon, ETO

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PART VIII

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PART VIII
GAS CASUALTIES

Gas Casualties.--No definite organization for attention to the medical aspects of chemical warfare existed in the European Theater prior to the autumn of 1942. Realizing the need for such organization, the Chief Surgeon of the theater requested that a medical officer specially trained to chemical warfare medicine be assigned to the theater. For the immediate need, Lieutenant Colonel Perrin H. Long, M. C., was appointed acting senior consultant in chemical warfare medicine 17 November 1942, serving in this capacity in the Division of Professional Services for a period of one month, at the end of which time he left the theater.

Colonel William D. Fleming, M. C., former Chief of the Medical Department Research Laboratory, Edgewood Arsenal, arrived in the theater in February 1943 and was assigned as Medical Gas Defense Officer, 24 February 1943. A new division of the Office of the Chief Surgeon was shortly established and later given the title of The Gas Casualty Division.

The division was divided into three branches, with interests centered in liaison, plans and training, and in administration and supply. The liaison branch effected close and continuous contact with all phases of chemical warfare, British and American, and with both research and military aspects. Results of investigations in chemical warfare medicine were circulated to the various installations of the Medical Department of the theater. The Plans and Training Branch worked to attain a satisfactory standard of proficiency for the Medical Department in training and medical aspects of chemical warfare and to adjust the Medical Department to the rapid changes in tactics and techniques of chemical warfare medicine. The Administrative and Supply Branch, in addition to the routine office administration, cooperated with the Supply Division, Office of the Chief Surgeon, in procurement and issue of adequate supplies and proper materials for medical service of gas casualties.

Several unavoidable circumstances definitely hampered many of the division activities. Obvious and outstanding among these was the non-existence of chemical warfare. Popular opinion

existed among the American forces that Germany would not introduce chemical warfare. Under such prevailing ideas, it was difficult to maintain interest in the Medical Department concerning chemical warfare.

Adequate requirements for the theater were not at first realized in personnel trained in chemical warfare medicine. Personal contact and repeated inspections were required to adjust the medical service to this subject. The problem of gas casualty supplies also hampered some of the aspects of the work. For example, adequate supplies for testing of water contaminated with chemical agents were much delayed and a method for detection of nitrogen mustard in water had to be developed.

Under the direction of Colonel Fleming, a strong program in training methods in chemical warfare medicine was developed. A comprehensive plan was developed for activities in this branch of medicine during the invasion. The results of medical research were circulated to the Medical Department. Members of the staff worked in conjunction with the British and a representative of the United States Navy in treating many industrial accident and other eye casualties resulting from chemical warfare agents; and a great deal of research work was done on the effect of chemical warfare agents on the eyes.

With the departure of Colonel Fleming for duty in the Pacific Theater, the Gas Casualty Division in the course of an office reorganization became The Gas Casualty Branch of the Division of Preventive Medicine, 13 January 1945. It continued to function as such until 11 June 1945.

Gas Casualty Branch, Division of Preventive Medicine. The policies and functions under which the Gas Casualty Division had operated remained unchanged when the work was incorporated into the Division of Preventive Medicine. They were founded on the many advances in medical knowledge of chemical warfare made in recent years. Outstanding among them were the rapid first aid measures, marked by the trend to self-aid as much as possible. Definitive treatment was determined by developments in research and the study of actual cases. Maximum utilization of Gas Casualty supplies was stressed, with location of the materials at points where gas casualties were expected or were to be received. (Figure 2) Special attention was directed to training and instruction of units most likely to be concerned in the medical service of gas casualties.

Policies.--First aid against gas was based on the principle that each soldier must be trained to carry out personal decontamination



Figure 1

Problems encountered in a gas barrage are simulated for U. S. Army nurses by the Chemical Warfare Service at the American School Center, Shrivenham, England, September 1944.



Figure 2

Two soldiers at the gas school in Northern Ireland wearing impregnated clothing, January 1944.

on the spot as his own responsibility and become familiar with the means available to him in the field to render this first aid. It followed that he was not to give up ground in the face of chemical attack, but to utilize these aids and his gas mask in continuing the fight. (Figure 3) Policies were reflected in three theater directives initiated by the original Gas Casualty Division in 1944.

Methods previously designed for reception and handling of gas casualties had largely been based on employment of elaborate decontaminating chambers with facilities for bathing. This obviously entailed lines of contaminated individuals awaiting their turns for shower baths. In line with established policies on first aid and to eliminate lines of contaminated individuals, a scheme was developed in which the decontamination chamber was largely eliminated, enabling a maximum number of cases to be handled in a short time.

The disposition of gas masks of personnel having communicable diseases, was left to the discretion of the responsible medical officer. If he considered the mask a possible source for the spread of communicable disease, disposition of the same was described.

In addition to the measures mentioned in training for first aid, steps were taken to assure adequate knowledge of chemical warfare medicine among Medical Department personnel. Special directions and equipment for treatment of gas casualties were grouped and issued.

Activities.--Training in the medical aspects of chemical warfare required repetition at frequent intervals. In order to clarify the policies of the theater for medical units, personal visits were made to hospitals for conference with commanding officers and gas casualty officers of each installation. Indoctrination in the theater policies of chemical warfare medicine was accomplished, and return visits made several months later at which time inspections were made to determine the standards of proficiency attained by the personnel. Hospital centers were afforded the primary indoctrination and thereafter carried out their own inspections, using a standard inspection check list.

Nine ports and sub-ports of the theater were visited for conference with port surgeons in regard to medical service of gas casualties resulting from air attack or accidents with chemical cargoes.

Kit Water Testing Poisonous.--The first of the newly developed kits for testing water for the presence of poisons and

for quantitative determination of chemical agents in water was received in the theater during the last week in December 1944. The supply of these kits was not sufficient to permit distribution, but the equipment was demonstrated to the gas casualty officers of the several Armies that they might be familiar with it and the auxiliary kits to accompany them. The regular item was ultimately made available and the first of the auxiliary kits was received 3 January 1945. This auxiliary kit supplied a means of determining the amount of fluorine in water.

Reestablishment of the Gas Casualty Division.--With the return of Colonel Fleming to the European Theater, on 11 June 1945, the Gas Casualty Branch of the Division of Preventive Medicine was again constituted as an independent Division of the Office of the Chief Surgeon and so functioned until the cessation of theater operations.

Personnel.--The direction of the Gas Casualty Branch of the Division of Preventive Medicine was the responsibility of Lieutenant General Albert M. Johnston, M.C., assisted by Captain Francis D. Brown, M.C. The staff included two enlisted men trained in chemical warfare medicine.



Figure 3

Periodic inspection of gas masks in the 83rd
Infantry Division at Courtil, Belgium, January
1945.

FIGURES

1. Problems encountered in a gas barrage are simulated for U. S. Army nurses by the Chemical Warfare Service at the American School Center, Shrivenham, England, September 1944.
2. Two soldiers at the gas school in Northern Ireland wearing impregnated clothing, January 1944.
3. Periodic inspection of gas masks in the 83rd Infantry Division at Courtil, Belgium, January 1945.

A HISTORY OF PREVENTIVE MEDICINE
IN THE
UNITED STATES ARMY
1941 - 1945

PART IX - Sanitation

By

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PART IX

Sanitation

So many new fields in Preventive Medicine have been explored and developed in recent years and so much of the emphasis in Preventive Medicine has turned from a consideration of things to one of people, that the true place of environmental sanitation in the maintenance of health tends to disappear from view. Good sanitation has come to be such a part of life, and particularly of American life, that it commonly is taken wholly for granted. The sharp jolt to complacency that can come from failure to observe the basic principles of environmental hygiene has been clearly demonstrated in those parts of this presentation concerned with typhoid fever and the diarrheas and dysenteries. Environmental hygiene still remains the basic discipline of Preventive Medicine, the foundation upon which programs and procedures are built.

An improved level of accomplishment in environmental sanitation has come from the increasingly evident extent to which trained sanitary engineers have taken over responsibility in this field. The modern engineer brings to these problems a kind of experience and an attitude which few medical practitioners possess.

The actual practice of sanitation in the European theater in unit areas was the responsibility of the unit commander. He had the assistance of his unit surgeon. The policies of major commands came from Divisions of Preventive Medicine at Headquarters of those commands, and Surgeons at that level almost invariably had sanitary engineers on their staffs on whom they depended for the development of procedures and the supervision and direction of work in sanitation. The guiding policy for the theater centered in the work of the Sanitation Branch in the Office of the Chief Surgeon.

The Branch was headed by a sanitary engineer, and his staff was made up of engineers and entomologists. The medical aspects of the work were effected through coordination with other branches of the Preventive Medicine Service, particularly those of epidemiology and laboratories, and through the chief of the service. The Sanitation Branch was primarily an organization of engineers and medical technical experts.

Policies and Functions.---The supervision and control of water supplies occupied first place among the fields of interest

in sanitation. The disposal of wastes was an important concern, primarily because of its relation to the potability of water, although of itself it contributed greatly to the decency and comfort of living and had a bearing on many phases of the maintenance of health.

The second general activity had to do with the cleanliness and orderliness of military installations, with attention devoted first to the sanitary facilities of camps, posts, and stations; and secondly to the mechanism of mess operations.

The third division of activity was related to the control of insects and of rodents. Important as these considerations were in the general program for limitation of the communicable diseases, the pest element was of no minor concern and the economic aspects have long been adequately appreciated.

The stated divisions of interest serve to give a broad conception of the work in Sanitation but fail to take into account the many diverse activities which enter into the conduct of a modern program of environmental hygiene. Perhaps more than any other part of the Preventive Medicine Service, the group in Sanitation found overlapping interests with the other branches of the organization, particularly with those of Epidemiology and Military Occupational Hygiene. In the administration of professional medical affairs in the theater, it sometimes appeared that matters which failed to fit with any of the established divisions of the Office of the Chief Surgeon found their way to Preventive Medicine. Be that as it may, if they came to the Division of Preventive Medicine they were referred more commonly than not to the Sanitation Branch.

A definition of policies to govern the work in sanitation was formulated in the early days of the theater and remained essentially unchanged throughout the course of operations. They were stated as follows: (1) To advise and make recommendations on all problems of water supply and water purification, sewerage and sewage disposal, waste disposal, rodent and insect control, housing and sanitation. (2) To investigate relevant sanitary situations in the field and to evaluate procedures followed and results obtained. (3) To make inspections of the sanitary facilities and sanitary conditions of proposed and existing camp sites, camps, billets, and stations. (4) To establish with the laboratory section a satisfactory organization for the routine control of the potability of water supplied to existing camps and stations. (5) To provide consultation and technical aid in the emergency disinfection of buildings, quarters, and other installations in respect to flies or other insect pests.

(6) To collaborate closely with the Quartermaster Corps and the Corps of Engineers in the provision of facilities for protection against lice, and for disinfestation of military personnel. (7) To assist in investigations of communicable diseases which have a direct relation to environmental sanitation. (8) To assist in the establishment and enforcement of standards of sanitation. (9) To effect liaison with British and civilian and military personnel and organizations in allied fields.

Personnel of the Sanitation Branch at Theater Headquarters.--Affairs of sanitation were a general function of the division until 24 July 1942 when Major (later Colonel) Emery C. Cushing reported for duty as theater entomologist. In addition to the technical duties associated with his specialty, he carried general responsibility for work in sanitation until it was organized as a special branch of the Division of Preventive Medicine under an expert sanitary engineer, Lt. Colonel Ralph C. Sweeney, on 12 October 1942. The association of Colonel Sweeney with the Division and the theater was short lived, because of the need for assigning him to other duties in the Mediterranean area. He was succeeded on 29 October 1942 by Major (later Lt. Colonel) Ralph R. Cleland, a sanitary engineer with much experience in Great Britain through his preceding connection with the Hospitalization Division of theater headquarters.

Colonel Cleland directed the operations of the Sanitation Branch from late 1942 until 10 February 1945. His principal assistants were Captain (later Major) Edmund J. Marzec, who joined the staff 18 January 1943, and Captain (later Major) James K. Latham, whose service dated from 8 June 1943. Captain Robert M. Lingo and 1st Lieutenant, (later Captain) James T. Gibbs, served for short periods before taking up duties in base sections.

Lt. Colonel Ralph C. Sweeney, returned to the theater from the Mediterranean area as a member of the forces of the Southern Line of Communications in the invasion of southern France. He succeeded Lt. Colonel Cleland as director of the Sanitation Branch on 7 March 1945 and remained in that position until the following June.

The activities in entomology were continuously under the direction of Major (later Colonel) Emery C. Cushing. He had as assistants Major Ralph W. Bunn, whose service dated from 25 June 1943, and Captain William L. Barrett who served on temporary duty from the First Medical General Laboratory for varying periods of time.

Water Supply

Water Supply.--Like most features of Preventive Medicine, the problems of water supply in the European Theater were greatly influenced by the nature of the operations in which troops were engaged at the moment, the conditions under which they were housed, and the country in which they were stationed.

During the long stay in Great Britain conditions were not essentially different from those of camp life in the Zone of the Interior. Many troops were in fixed installations, oftentimes in camps previously occupied by British troops. Water was usually drawn from old established water supplies, in many instances from municipal sources that had existed for years and whose sanitary qualities were well known.

The unusual demands of troops often overtaxes existing supplies and augmentation was frequently necessary. Many times emergency purification measures had to be installed. The result was that every water supply did not reach the standard to which soldiers had been accustomed in America and much education was necessary to change the too frequent attitude that any water drawn from a tap was safe.

Field methods of purification were only employed to meet emergencies, and individual purification of water was almost unknown in Great Britain. Not until troops moved into the marshalling areas in preparation for the invasion of Normandy did the Lyster bag make its appearance in any numbers and many troops were there introduced for the first time to the conditions of water supply which mark operations in the field.

Conditions on the continent were wholly another matter. In the early days of the campaign the soldier came to depend in large measure on the individual methods of purification which he himself employed. The need for water discipline became a part of every day life. When unit water supplies came into existence, they were field water supplies. Safe water was supplied, but it was of limited quantity, not too easy to get, and it had to be chosen with care.

Service troops and others in fixed installations many times had the advantage of established and ordinary water supplies as conditions became stabilized, but the soldier of the field Army continued to depend in large measure upon the water the Corps of Engineers could get for him and the quantity that they could reasonably supply. Not until field operations ceased in May 1945 did American troops return to the conditions which had characterized camp life in the United Kingdom.

Water Supply in the British Isles.--Water in the British Isles was never abundant. The British public was not accustomed to the amount of water supplied to the average inhabitant of the United States, a country which is probably the most wasteful of water in the world. The average consumption per capita by the American soldier in Great Britain was about one-half that to which he had been accustomed. Much of this was a matter of necessity. The size of the streams in the United Kingdom was much less and the density of population much greater. A situation comparable to a third of the population of the United States concentrated in an area the size of South Carolina does not provide sufficient catchment area to be especially liberal with water. A severe drought also prevailed in England from 1942 to 1944 and brought about a situation sufficiently serious to require a rigid conservation of water to meet the needs of troops and of the country as a whole.

The scales for water to be supplied to troops came about through mutual agreement by the Medical Department, the Corps of Engineers, and the British War Office. The amounts were based on imperial gallons per person per day, an imperial gallon being the equivalent of about 1.20 United States gallons. Where a water borne sewerage system existed, 20 gallons per person per day was provided all establishments other than hospitals, where patients were allowed 50 gallons per day. Where no water borne sewerage system existed, all established units other than hospital patients and men living in temporary tented camps were allowed 10 gallons per person per day. Hospital patients received 40 gallons, and men housed in temporary tented camps had five gallons.

An allowance for vehicles of various types was also established. Other than tanks, all vehicles had an allowance of 10 gallons per day and tanks irrespective of size received 40 gallons.

While the quantities provided were much less than those to which Americans had been accustomed, (200 gallons per day is not at all uncommon in American cities) on the whole the quantities allowed proved ample for most sanitary purposes when economy was practiced and an individual sense of responsibility developed.

Purification.--Regardless of the presumed or established quality of a water on the basis of previous experience, chlorination was required of all water supplied to United States troops. This precaution was necessary by reason of the altered conditions associated with troop installations. Water supplies were in many instances overtaxed, as were the facilities for purification. The altered

conditions of a wartime existence tended to disrupt ordinary control of procedures for water treatment, and bombing incidents introduced emergency problems. The reliance on past history and performance of a supply was no longer justified.

Most water supplied to American troops came from municipal water supplies, which were seldom chlorinated to an extent that met American Army standards. Sometimes chlorination had not been employed previously and it was necessary to introduce that process. To meet minimal military standards auxiliary chlorinating systems were installed at the source or more commonly chlorinating apparatus was introduced into the course of the mains that delivered water to the camps. (Figure 1)

Deep wells were a common source of supply where water was not taken from nearby municipal supplies. Chlorination was ordinarily the only treatment required.

Standard British practice in chlorination differed from that ordinarily employed in America in that the usual method was chlorammoniation. This arose from the strong objection on the part of the consumers to the taste of chlorine so regularly associated with simple chlorination. Chlorammoniation requires a long period of contact for water purification, compared with ordinary chlorination, and sufficient storage facilities to provide at least four hours detention during periods of peak flow were commonly lacking. Consequently the British War Office agreed to the application of chlorine alone as the type of purification to be furnished United States camps. Newly installed plants were of this nature.

Chlorination by hand treatment often had to be employed in the storage tanks of the many castles and manor houses used for quartering troops. These tanks were usually uncovered and often located in inaccessible attics. In some instances they had to be rebuilt in order to insure a safe water.

The shortage of chlorinators which existed in the early days of the theater was overcome by dividing the chlorammoniators provided by British manufacturers in such a way that the dual apparatus consisting of an ammoniator and a chlorinator were both used for simple chlorination.

Whenever practicable, a residual chlorine content of 0.4 parts per million was maintained. The only exceptions permitted were instances where properly treated municipal supplies were furnished to distant stations.



Figure 1

Elevated water tank built by British contractors for
U. S. Forces, England, January 1943.

Water supplies from deep wells, after adequate treatment with chlorine, although hard were usually relatively pure as determined by bacteriological tests. Surface supplies and others containing much suspended matter were sometimes subjected to coagulation, sedimentation, and filtration through steel pressure filters. These more elaborate systems of water treatment were limited almost entirely to water supplies furnished to hospitals.

Adjustment of the alkalinity and hydrogen ion content of water was rarely necessary, but when corrosion of water lines occurred or the possibility of plumbo-solvency existed, lime, soda ash or sodium silicate was added. Taste and odor problems were uncommon, one of the outstanding experiences being a heavy infestation of a hospital water supply with *Synura*. Super-chlorination was employed to remove a fishy taste and odor from the filtered water.

Storage.--When water supplies were taken from a municipal water supply having reservoir capacity sufficient for two or more days total supply, storage facilities at military installations were limited to 25 percent of a normal day's supply, except where a long or vulnerable main existed or where the distribution system was heavily overloaded, in which case a storage requirement sufficient for a full day was mandatory. Storage of water sufficient for one day was likewise required when water was obtained from supplies located within camps or other installations. (Figure 2)

Storage tanks were constructed of available materials such as timber, brick, steel or concrete. Those used for domestic water supplies were covered in the most economical manner practicable, in order to reduce growth of algae by excluding sunlight, and to prevent pollution from accumulation of leaves, dust, and other extraneous matter.

Cross connections between static storage tanks for fire protection and the sources of potable water existed many times. Through faulty construction, the inlet pipe was often submerged below the water surface. Correction was accomplished by severing the inlet pipe above the surface of the water. Such uncovered static water tanks were a familiar part of the British war time scene. They were built at ground elevation and located in sufficient numbers throughout a given installation in order to store water for fire fighting. They were augmented with suction hose, pumps and discharge hose lines.

British public health regulations required the installation of storage tanks inside dwellings and other buildings in

order to break the connection between the water supply and the heating system. In many of the manor houses and other buildings requisitioned for troops, the storage tanks were not covered and bacteriologically satisfactory water supplies could not be provided until the tanks had been cleaned, chlorinated, and covered.

Bacteriological Control.—Bacteriological analysis of water supplies of all stations of the theater was required at monthly intervals. In the early days of the theater this was not possible and such water examinations as were made were through the assistance of British municipal and public health laboratories. By August 1942 the laboratory facilities of the United States had reached sufficient development that monthly routine examinations were thereafter made mandatory.

Many of the examinations were made at the First Medical General Laboratory, and the services of that organization were available to all units of the theater. Probably the greatest proportion of such tests were performed at laboratories of station and General Hospitals. Instructions were issued on the proper technic for obtaining samples to be submitted to laboratories. Experience had demonstrated that reports indicating an unsatisfactory water arose in a number of instances from lack of care in obtaining a sample of a water which otherwise met all prescribed requirements. Bottles for the collection of water samples contained sodium thiosulphate to neutralize the residual chlorine. Reports of water examinations were made to the unit Surgeon submitting samples and to the Surgeon of the Base Section, Air Force or Army to which the unit was assigned.

The environmental examination of a water source has long been recognized as a consideration of equal importance with laboratory examinations in determining the satisfactoriness of waters for human consumption. Upon receipt of laboratory reports of a non-potable water a field investigation was made by a representative of the Surgeon of the major command concerned, with the purpose of tracing the source of contamination. What had been considered a safe water supply could often not be so classed until chlorination was established or other means practiced for protecting the water system, such as covering elevated storage tanks, ferreting out cross connections or sterilizing mains.

Hardness of Water.—With the exception of some localities in Wales, northwest England and Scotland, the water encountered in the United Kingdom was regularly hard, especially that derived from



Figure 2

Field demonstrations of pump and filter units of a portable water purification apparatus, England, December 1942.

deep wells. Water softening by the water authorities on the scale practiced in the United States was relatively uncommon in Britain. Consideration was originally given to the introduction of water softening plants for treatment of general supplies but the lack of available equipment precluded that practice. As a substitute, zeolite softeners were commonly installed on dish washing machines and for the water furnished hospitals for operating rooms, nose and throat departments and laboratories, where the hardness of the water exceeded 100 parts per million.

Sterilization of Water Mains.---The standard British practice in sterilizing newly constructed water mains was to fill the mains completely with a solution containing 10 parts per million of chlorine, which was allowed to remain in the main for four hours. This amount of chlorine was increased to 50 parts per million for a period of 24 hours, and even that was not always effective, as illustrated by the experience of one hospital where repeated treatments were necessary, although the water came from a satisfactory municipal supply.

Water Supply in Continental Operations.---The restrictions on the amount of water supplied to troops which is such an intimate part of operations in the field, first went into effect when the Ground Forces entered the marshalling areas in southern England in preparation for the invasion of the continent. Conditions approximated those of an active campaign. Water was hauled to the camps in trucks and provision was made to supply quantities of three and a half gallons per man per day. Troops were carefully instructed in water discipline, were warned that the quantity of water would soon be still more limited, and were further advised that the quality of the water in the country soon to be invaded was far from that to which they had been accustomed. For the first two days of the assault, the water allowance was two quarts per man per day.

In plans for the construction of Communications Zone installations on the continent, the amount of water allocated was five United States gallons in instances where a waterborne sewerage system did not exist, and 15 United States gallons per man per day when such provision was present.

The amount of water supplied to combat forces in the course of operations varied a great deal and was largely governed by the particular circumstances under which they were operating. No average figure can be given for the usual consumption of water by units in the line. A common figure was about one gallon per man per day. Naturally when troops entered rest areas or were in

reserve in semi-static installations, the amount of water provided was much greater.

Purification.--Water for the forces in the field was secured primarily from water points operated by the Corps of Engineers, who made use of any available supply irrespective of its quality, such as rivers, lakes, ponds, wells or whatever was at hand. (Figure 3) The water was filtered, using the United States Army portable water purification unit, model 1940, with a rated capacity of 75 gallons per minute.

Several deficiencies in the purification process were observed under actual field operations, which made it necessary to revise the procedures. In the first place, the use of ammonia gave rise to chloramines; and the high nitrogen content of many surface waters likewise contributed to the same effect. The rainfall in the autumn of 1944 commonly produced an excessive turbidity of surface waters. Filters were often operated at more than the rated capacity and the necessary pre-coagulation and sedimentation was not always practiced. To eliminate these operational faults and to assure the removal of entamebae, precise and altered directions were issued in respect to sedimentation and coagulation processes in the operation of the standard field water purification units. (Figure 4)

The prescribed method of treatment provided a one hour period of coagulation, settling and prechlorination, followed by filtration at a reduced rate of ten gallons per minute for the portable unit instead of fifteen gallons per minute; and sixty gallons per minute instead of seventy-five for the mobile unit.

When first introduced this procedure was required only in selected instances. A comprehensive survey by the Sanitary Engineer of the Third Army showed a far greater proportion of waters to be non-potable by bacteriologic standards than was desirable. Regulations were therefore amended to make pre-chlorination, coagulation and settling of waters universally obligatory prior to filtration except in emergencies and on specific permission of Surgeons of major commands. General institution of this procedure not only improved the quality of the water bacteriologically, but clarity and taste were better. An increased output of the filters likewise resulted, in spite of the lower rate of filtration that was used, because filter runs were increased with a consequent saving in backwash water.

The general improvement effected was shown by the experience of the Third United States Army for the autumn of 1944. Only 51 per cent of waters examined bacteriologically in August were potable. The proportion was increased to 72 percent in September, and in October the rate was 85 percent. Tests during November showed 89 percent of all waters examined to be potable and December 95 percent.



Figure 3

A portable purification unit and settling tank is operated by the 1142nd Engineer Group, Ninth Army, at Gulpen, Holland, March 1945.



Figure 4

German Prisoners of War waiting to draw water, Germany, April, 1945.

Water Supply in Redeployment Staging Areas.--The construction after the war ended of tented camps in the Assembly Area Commands to house transient populations of over 750,000 men in connection with redeployment activities, placed an excessive demand on the available equipment for field water treatment. Although standard scales provided five gallons of potable water per man per day, experience indicated that a minimum of ten gallons was desirable. The available equipment was insufficient to treat the required quantity of water. Wells were drilled where satisfactory supplies of ground water could be obtained at a reasonable depth, and treatment plants for surface waters were installed where equipment was available. Coagulant was added to the water by means of a simple solution feeder prior to mixing and settling in tanks having a holding time of from one to two hours. The treated water was passed through pressure filters at a rate of three gallons per square foot per minute and chlorination accomplished by pipe line chlorine feeders.

Water Discipline.--Water discipline in combat units improved as soldiers became accustomed to field conditions. Epidemics of common diarrhea due to water borne infection were always uncommon and eventually became a rarity. More untreated nonpotable water was ordinarily consumed by Ground Force troops in the rear areas than in the forward zone, primarily due to the natural laxity and letdown associated with rest areas and fixed installations, but also through leave in municipalities not having approved water supplies.

As for troops of the Communications Zone, many units had spent considerable periods in Great Britain or were newly arrived from the United States. The common attitude toward any water coming from a tap was that it was potable and that it was the responsibility of others to see that it was so. Such water supplies were frequently used when not authorized in spite of definitely posted instructions to the contrary.

Water supply in occupied Germany.--As the troops of the Army of Occupation took up their duties effort was made to remedy sanitary defects in existing water supplies and to bring them to the level of United States Army standards of potability. The general policy was to release troops from the obligation of using field methods of water purification; in a way a matter of necessity because with the cessation of operations water discipline expectedly deteriorated.

Water supply in prisoner of war enclosures.--The large number of prisoners captured and held in Germany toward the end of

the war placed too great a demand upon the available water treatment equipment. (Figure 5) It was impossible to furnish a completely treated water and chlorinated river water was frequently piped into the enclosures.

Difficulties in Winter Operation of Field Purification

Units.--Operational difficulties were experienced during the winter due to freezing of water tanks, filters, barrels and hose lines during extremes of cold weather. (Figure 5) The difficulties were usually overcome by installing the filter and pumping equipment in a pyramidal tent heated with a tent stove or other heating unit; by draining the filter, hose lines and pumps when not actually in use; and through recirculation of the water in the settling tanks, clearing them well when not in use, or installing an immersion type heating unit in the tank. The canvas storage tanks often froze to the ground, with ice sometimes reaching a thickness of more than six inches around the base. The tanks were moved with difficulty, and damage occurred with resultant leaks.

Bacteriological Control.--During the early days of operations on the continent sufficient laboratory facilities were not available to accomplish the monthly examination of water supplies practiced in Great Britain. Furthermore, units changed location so frequently that bacteriological examination of a particular water supply was rather useless. Water points shifted with equal frequency.

Examinations for residual chlorine were consequently stressed as the most reliable index of a safe water. Bacteriological examination was required only of samples taken from water points operated by engineer units and not from the provisions of the individual water users. Waters originating from sources other than official water points, usually municipal or other fixed supplies used by static units particularly of the Communications Zone, were examined. As the campaign progressed and conditions became more stabilized, laboratories came into operation and the routine examination of water supplies was resumed. The service was provided by hospital laboratories, by the Medical Laboratories of Armies and by the central laboratory service in Paris.

Individual and Unit Purification of Water.--Field methods for purifying water in small quantities by the individual soldier consisted mainly of the newly developed Halazone tablets. Units employed Lyster bags with hypochlorite. The prescribed two Halazone tablets per canteen were many times insufficient for proper purification because of the high chlorine demand of the water. Some divisions introduced instructions requiring three tablets of 4 mgm. each for clear water and four tablets for turbid waters. Eventually this became general practice in most field armies of the theater.



Figure 5

A water tower near the front line, Haguenan Area, France, in January 1945.

The standard treatment of water in Lyster bags involved the addition of one ampule of calcium hypochlorite per Lyster bag of water. This also frequently proved insufficient to produce a potable water, and additional ampules were added until orthotolidine residual tests for chlorine indicated an available chlorine content in excess of one part per million.

Municipal Supplies.---Satisfactory municipal supplies on the continent were the exception. In many instances battle or bomb damage had disrupted the municipal water purification plants. Where that had not occurred water purification practices commonly failed to meet United States Army standards, in that rates of filtration were too high, insufficient sterilization was practiced, laboratory facilities were lacking or the available personnel for operation of water plants were improperly impressed with the necessary responsibility. The Paris water supply system was excellent.

For the most part municipal supplies on the continent were derived from shallow wells, surface streams, or from springs in the surrounding hills, in which case water was secured by means of collecting galleries. Filtration was ordinarily accomplished by the slow sand process, European style. The water was first run into roughing filters where the filter bed consisted of a layer of coarse sand to a depth of about 70 centimeters. Following that, the water passed through the final filters having approximately the same depth of sand but of a much finer size. Rates of filtration varied from 15 to 30 cubic meters of water per square meter of filtering surface per day for the roughing filters, and from 4 to 8 cubic meters per day for the second stage of filtration. Although the rates of flow were greater than those normally employed in the United States, a fairly good water was usually obtained.

Purification by chemical means was accomplished by chlorine gas or Eau de Javelle (sodium hypochlorite solution). Ozonation was used by some water authorities but chloramination was not practiced as generally on the continent as in the United Kingdom. Whatever the method of treatment it was usually impossible to detect residual chlorine in the water as it left the purification plant, for the reason that rates of application of chlorine varied from 0.02 to 0.20 parts per million; quantities which were more than consumed by the chlorine demand of the water.

Largely for this reason municipal supplies were rarely approved for use of United States troops unless the water was subsequently treated by Lyster bag or the Halazone method. Deep wells were not a common source of water supply as in the United Kingdom or in the United States.

Gas fed chlorinators and hypochlorinators became more readily available in early 1945, and many units especially hospitals were provided a potable tap water. Chlorinators were most commonly installed on the mains leading from municipal supplies to the occupied buildings, although complete municipal supplies were sometimes chlorinated. The existing javelle water feeder was placed in operation with the dosage sufficiently increased to assure a potable water.

Beer and Other Beverages

Under conditions in the British Isles the problem of morals was not as significant as it was during continental operations. The language was similar or at least understandable, and the soldier readily adapted himself to the life of the country. The Special Services organization helped him in this, but one activity not sponsored by Special Services was the custom he developed of visiting the local British pub which ordinarily was within walking distance of any American installation. Here he had opportunity to talk with the average man of the country, for the British pub is the poor man's club; and while so doing he had opportunity to drink his beer.

The opportunity to obtain such beverages on the continent was more difficult, especially in regions such as Holland, Belgium, and Luxembourg. The particular service that was needed was for combat troops. The greatly increased frequency of poisoning by methyl alcohol among troops of the line through drinking nondescript liquor was a principal reason for providing through army auspices a safe and relatively innocuous drink.

Furthermore the troops came back to rest areas in bivouac or in quarters in towns where the existing facilities for relaxation were over taxed and provision necessarily had to be made by the army. The morale of a soldier resting after combat was an important consideration.

The brewing industry in the countries concerned had a reputation famous for centuries but many manufacturing plants had suffered deterioration or partial destruction as the result of the war. It was

essential that the beer provided come from a sanitary environment and be free from disease producing germs; and assurance was furthermore necessary that the product had not been deliberately poisoned by the enemy.

An inspection team to make special surveys of facilities for providing beer and soft drinks included a sanitary engineer, a toxicologist and a beverage expert from the Special Services Division at Headquarters, ETOUSA. The engineer checked on matters of sanitation connected with the brewing industry such as water supplies, cleaning of vats, hose lines, bottles and tanks; sanitation of toilets and lunch rooms within the brewery, and the personnel hygiene of the employees. The toxicologist was concerned with the possibility of poisoning, either deliberately or by accident, and with toxic effects which might develop from the processes employed, such as the use of sodium fluoride in maintaining clean hose lines. The Special Services Officer was primarily concerned with procurement and distribution of the final product.

The possibility was originally considered that the bacteriological standards established for water might apply to beer, particularly the absence of coliform organisms. This was found later not to be true. Most specimens of beer contained lactose fermenting organisms not necessarily indicative of fecal contamination. This was due to various factors. The fermentation tanks, in many instances holding thousands of gallons of beer, could not be adequately sterilized. Bacteria survived the fermentation process and subsequent storage for several months. Barrels and bottles likewise could not be sterilized. The normal peacetime practice was to coat the interior of barrels with pitch just prior to each filling, but shortage of pitch and of fuel to heat it did not permit this practice.

The water used in the production of beer often came from private sources, commonly owned by the brewery and located on the premises. Purification of the water was not attempted, because it interfered with the taste and production of beer.

Principal stress in the measures introduced by United States authorities was to assure that the product was produced under satisfactory sanitary conditions, that employees had the necessary physical examinations, and that practices in personal hygiene were in compliance with the usual standards for food handlers. Sodium fluoride was eliminated as a measure for cleaning rubber hose lines and chlorine substituted as a sterilizing agent.

Most of the breweries were found acceptable when operated under conditions of American sanitary control. No instance ever came to the attention of army authorities of an outbreak of intestinal infection traced to beer. (Figure 6).

Disposal of Wastes

Garbage.--The nature of the food consumed by troops in the European Theater, consisting as it did so largely of dried eggs, boned meat, dehydrated vegetables, and the various types of field rations, materially lessened the quantity of garbage, and left little residual waste. The active campaign of food conservation contributed to the same end.

The standard practice for disposal of garbage wastes required segregation of materials into four groups. The first was edible garbage suitable for feeding to animals. Non edible garbage was distinct from combustible trash such as paper and boxes not suitable for salvage, and from material such as ashes and bottles.

In the United Kingdom edible garbage was universally sold to civilians for animal food. British law required that this be done for all wastes of civilian origin and the United States Army cooperated in respect to materials derived from American military installations. Garbage, less grease and bones which were required to be salvaged, was sold at a price of fifteen shillings (\$3.00) per month per each 100 men assigned to a mess. The arrangements for sale were effected through the British Command and the British Catering Advisor of the district in which the camp or station was located. Grease and bones were collected in separate containers and given to the British through the same channels provided for the sale of garbage. In order to prevent foot and mouth disease, bones were required to be boiled before leaving the kitchen.

Garbage and other waste materials presented few problems on the continent. Materials were usually given to civilians, buried or burned. The difficulties occurring in municipal areas were usually those which arose through disruption of collection facilities.

Human Wastes.--The disposal of human wastes in the United Kingdom was aggravated by the limited volume of the streams suitable for disposal by dilution. A policy was therefore adopted that except where water supply, site conditions or accessibility to existing sewerage systems made provision of water borne sewerage more practical, that bucket or pit latrines would be used. The bucket method was most

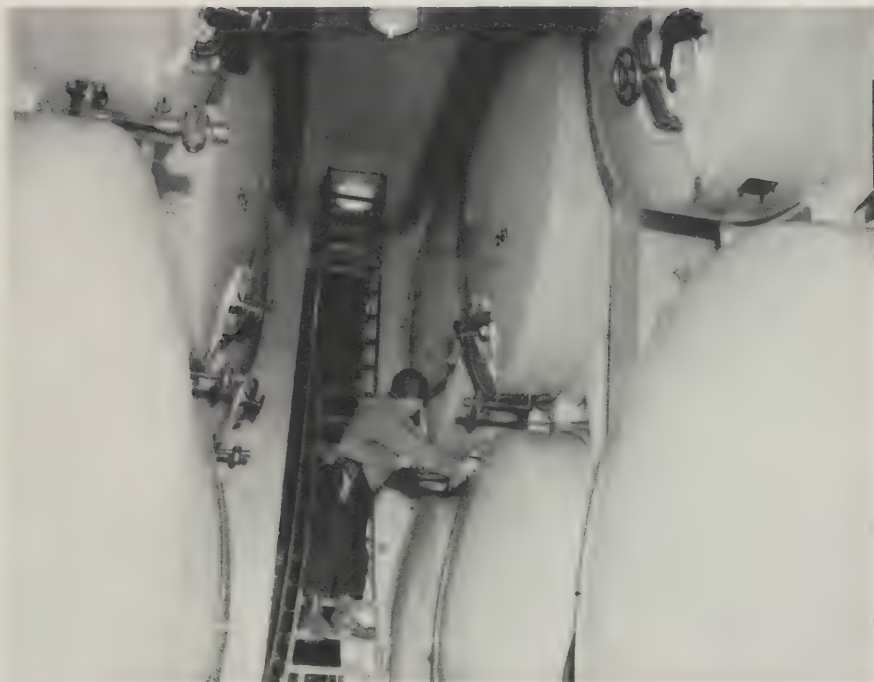


Figure 6

Testing beer before distribution to First Army troops
in Belgium, November 1944.

commonly employed with buckets provided on a scale of five per hundred men. Pit latrines were used only in occasional instances, although preferred to bucket latrines when in the opinion of the Senior Regional Medical Officer of the Ministry of Health their use did not endanger water supplies or otherwise affect public health.

The wastes from bucket latrines were disposed of by civilian contract wherever practicable. When that could not be arranged, disposal was accomplished by troop labor, either by emptying the material in a nearby sewerage system, by burial in shallow trenches or pits in which case approval was necessary from a representative of the British Ministry of Health, or by incineration where frequent use was made of the Army School of Hygiene feces destructor.

Pit latrines were more commonly used in the days immediately preceding the invasion of Normandy, especially in the marshalling areas. Fortunately the area involved made this possible, for the supply of buckets approached exhaustion with the increased troop strength that had to be served and the difficulties in disposing of wastes which accumulated in such large amounts within limited areas.

The bucket latrine method of feces disposal had many disadvantages. It was a method of disposal foreign to the American soldier and he often ridiculed its use. A man will straddle a trench under field conditions but using a bucket for the same purpose in a fixed installation was not accepted with enthusiasm. The disposal of the bucket contents and the maintenance of a satisfactory sanitary state of the latrines was often accomplished with difficulty because of the limited number of civilian contractors. When disposal was of necessity done by military personnel it was an objectionable and disagreeable assignment.

Buckets contained two percent cresol solution to a depth of about one inch, for the purposes of controlling odors. The deodorant was in critical supply and many times could not be obtained. Under agreements effected with civilian contractors the empty buckets were supposed to be washed, but the satisfactoriness of the result depended upon the individual operator. In some instances bucket washing equipment was installed.

The disposal of bucket contents by contractor was again not always satisfactory from a hygienic standpoint, because of the common practice of composting the material with manure to make

fertilizer. Burial led to the same undesirable effect as came from the use of pit latrines. Dumping on the surface of the ground by irresponsible contractors led to pollution of streams.

Pit Latrines.--It was unfortunate that pit latrines could not be used feasibly. In the first place the density of the population in many sections of the British Isles made it difficult to obtain land for this purpose, so located as not to contribute a health hazard through endangering water supplies. Much of the southern part of England also had a superficial underlay of chalk which because of its geologic nature and the readiness with which fissures formed, led to contamination of underground water supplies. The high water table in many sections, especially in the midlands and East Anglia, at times within a foot of the surface, precluded the use of pit latrines. Other considerations were decidedly advantageous to properly constructed installations. Flies were not present in the numbers found in the United States, and temperatures were not sufficiently high to cause nuisances from odors.

Incineration of feces.--Disposal of feces by burning was utilized only as a last resort and the practice was unsatisfactory at best. The British Army developed a flash burner utilizing crank case oil and water. Combustion of organic matter did not take place until the liquids had been evaporated and the cooking process was responsible for decidedly offensive odors in the absence of a strong breeze to windward. (Figure 7)

Other difficulties arose from improper location of the apparatus, from the fact that gases could not be burned in the stack as the design contemplated and because the metal parts of the incinerator burned out or buckled from the intense heat. It was difficult under any circumstances to charge the incinerator with fecal matter without spillage. It is apparent that the operation of the apparatus was not a task undertaken voluntarily by American soldiers. Prisoners of war were sometimes used for the work, but incineration never proved an acceptable method for the disposal of human wastes.

Bath, Ablution and Kitchen Wastes.--Even for bath, ablution and kitchen wastes where preliminary grease trap treatment was practiced, disposal by dilution was not satisfactory and in many cases caused water of streams to be unfit for cattle drinking aside from considerations of human health.

Where complete sewerage systems were not available to receive liquid kitchen, bath and ablution wastes they were disposed of



Figure 7

Feces incinerator, British design.



by soakage pits or tile drainage fields where soil conditions and water tables permitted.

Chemical treatment in sullage tanks was otherwise employed. Disposal by the methods first mentioned was not often practicable and the design for tented and hutted camps and hospitals usually provided for sullage tanks.

Sullage tanks were constructed of brick or concrete, varied in capacity from two to five thousand gallons, and had the necessary valve arrangement for decantation and sludge removal. Liquid wastes were received through sewers and the tanks operated on the fill and draw method. Ferrous sulphate in solution was added at the rate of 3.5 pounds per 1000 gallons and the contents stirred for 20 minutes, following which a milk of lime solution was added at the rate of 4.8 pounds of the dry chemical per 1000 gallons. After additional stirring and settling the supernatant was run off into a stream or ditch or allowed to soak into the ground. The precipitated wastes were drawn on to sludge drying beds when appreciable quantities had accumulated.

Sewage Disposal plants.--The sewage disposal plants constructed for United States installations in Great Britain followed standard British practice and were designed by civilian firms acting as consulting sanitary engineers to the British War Office. (Figure 8). Sedimentation tanks provided for ten to fourteen hours detention of sewage. Trickling filters had a rated capacity of 70 gallons of sewage per cubic yard of filter medium per day. Subsequently the material was passed to humus tanks where it was held for four to six hours. The final part of the process made use of sludge drying beds so designed as to give 1.3 to 1.5 square feet of surface per capita. (Figure 9).

The British operating procedure had the disadvantage that during the treatment daily withdrawal of raw fecal matter was required direct to the sludge beds. In cooperation with the Corps of Engineers a bulletin was prepared outlining methods of operation which assured that no nuisance was created. Under this procedure sludge was withdrawn at intervals of ten to fourteen days. During summer months the sludge was retained in the primary sedimentation tanks as long as the sludge capacity permitted or until septic action resulted in rising solids and lowering of efficiency of the trickling filter.

A lime treatment process was introduced employing hydrated lime which was added to the raw sewage entering the primary tanks.

This acted as a precipitant and produced an innocuous sludge which drained more readily. Addition of lime was at an average rate of 50 pounds per thousand gallons of sewage.

Standard British practice for smaller plants required that sludge drying beds be filled by successive drainings onto beds containing sludge which had been partially drained and dried. The process was changed so that the beds were completely filled at one time and dewatering was thereby enhanced. The chlorination of sewage effluents was not practiced.

Ponding often occurred on trickling filters from excessive loads and small size of filter medium, which in many instances varied from one-half inch to one inch. When ponding occurred the British practice was to remove the stone to a depth of six inches and replace it with new stone. It was determined by experiment that improved results followed when the surface of the filter was covered with high test hypochlorite for several successive days, the rate of application being one-fourth pound of the chemical per square yard of filter medium. In many instances it was necessary to replace an unsatisfactory filter medium with one of larger size.

Coke was used in early operation of some of the trickling filters but was later discontinued because of the need for conservation of fuel. Vitrified clinker, slag, or hard stone was substituted.

The effluent derived from sewage treatment plants at United States Army installations was generally unsatisfactory because of the high biochemical oxygen demand. Treatment plants at hospitals gave the greatest difficulty. The design, construction and operation were often unsatisfactory and many times plants could not be operated efficiently at the rated capacity. Since the British War Office was responsible for the quality of the effluent, the responsibility of the United States Army was limited to testing the results of treatment and to offering recommendations. Chemical precipitation with lime proved satisfactory in plant tests but failed under actual operating conditions because of improper application of the coagulant.

Sewage Disposal on the Continent.--Because of the unsatisfactory design and construction of sewage plants in Great Britain new standards were prepared for the continent wherein the sedimentation



Figure 8

Sewage Disposal Plant under construction by British contractor,
England, January 1943.



Figure 9

Sewage Disposal Plant at Langford Lodge, North Ireland, January 1943.

tank was replaced either by a septic or an Imhoff tank. Little actual construction of permanent sewage treatment plants was ever done because of the availability of permanent sewerage facilities where water flushed toilets were used. Other than units of the Services of Supply in permanent stations the movement of troops was so rapid from Normandy to Germany that little need existed nor was much thought given to the development of permanent sewage disposal facilities.

The Vidangeur.--In the absence of sewerage systems the continental practice in collection of human excreta made use of water-tight vaults or cess-pits. As the vaults filled, the contents were pumped into tank trucks. The vidangeur who accomplished this task was as important a member of the community as the baker, the butcher or other village tradesman. Because of the disrupted conditions in the wake of the war many of the vehicles employed in the trade were out of commission through lack of parts, or had been destroyed. Consequently many U. S. Army vehicles were turned to this use when required by the needs of installations occupied by United States troops. This system of disposal was limited to towns and stations where troops were more or less permanently located. It was not selected by choice but was simply a question of making use of facilities that were available. New construction was not undertaken except as no other alternative existed. The method was again decidedly unfamiliar to the American soldier but in general he ranked it ahead of the British bucket latrine from an esthetic standpoint.

Field methods of disposal.--Three methods were used in the field for the disposal of human excreta, cat-holes, straddle trenches and pit latrines. Pit latrines could be used satisfactorily almost anywhere on the continent, in contrast to the conditions which existed in the United Kingdom. Before formally developed facilities became available to hospitals in course of construction, bucket latrines were commonly used for patients in wards and pit latrines for the hospital personnel.

Convenience more or less determined excreta disposal or its lack under combat conditions. A man does not have much choice in the course of street fighting or when he is pinned down in a foxhole.

Mess Sanitation

From a sanitary standpoint primary distinction is to be made between the messing facilities provided troops housed in permanent installations and those available to them under field

conditions. In Great Britain and on the continent the Ground Forces usually used field equipment for messing.

Practice among the Air Forces was more diverse. The Eighth Air Force in the United Kingdom generally developed fixed installations for messing and field methods were uncommonly employed. On the continent the situation was essentially reversed. The Ninth Air Force was a tactical unit working closely with troops and transfers of location were frequent. Consequently field conditions of messing were almost universally employed.

Practice was more mixed for the Services of Supply and the Communications Zone. In the United Kingdom a large proportion of units lived under fixed conditions and had regularly established messes. A goodly number of organizations were under field conditions, especially engineer construction units and others. Hospital installations which entered so largely into the complement of Service Forces messed almost entirely under fixed conditions. On the continent the Communications Zone like the two other major components of the army operated primarily under field conditions and made use of field messes. Hospitals were the common exception, other than principal headquarters.

The facilities provided organizations making use of permanently constructed kitchen and messing arrangements rarely compared with those of the Zone of the Interior. Those in the United Kingdom were provided largely by the British through lend-lease arrangements, and were less elaborate than those of the United States Army at home. This came about because of the policy initiated by European Theater headquarters early in 1942 that time, materials and labor should not be devoted to elaborate construction with the exception of hospitals. The whole program was predicated on a brief stay in Great Britain which lengthened nevertheless to more than two years.

Door and window screens were not often provided, and stoves and ovens were of a type not considered modern by American standards. Floor drains were often lacking and grease traps poorly designed. Storage facilities for perishable foods were not always adequate. Hospitals were usually provided with modern kitchen equipment such as dishwashing machines, sink and hot water facilities for pots and pans, well drained concrete floors and screening.

The simplicity of field arrangements for messing made for a ready control of sanitary arrangements. Each soldier cared for his own messing utensils and community dish washing presented no problem. Rations were issued daily and perishable foods were so few that storage gave no difficulty. Garbage and other wastes were readily buried or incinerated, and conditions likewise acted to make the

amount of this material minimal. Left-over foods which so commonly caused trouble in messes of fixed installations, were usually discarded under field conditions rather than stored for future consumption.

Under all conditions hospitals with well ordered permanent installations of kitchen equipment and messing facilities fared very well. So did the troops in the field because of the simplicity of their arrangements. The greatest difficulties in mess sanitation from a theater standpoint were associated with those units, principally of the Services of Supply, which had neither one nor the other. Living under temporary semi-permanent conditions and consequently not using field methods of messing, they also lacked permanent equipment, and the makeshift arrangements under which they functioned were far from satisfactory. Many were housed in old manor houses, in hotels, barns and other buildings where the space allowed for kitchens and mess halls was too limited. The greatest difficulties, and the most frequent accidents in respect to outbreaks of diarrheal disease occurred in these situations.

Mess Kit Laundries.--The standard method for washing mess gear when troops were first stationed in Europe made use of three galvanized iron cans with a capacity of about 25 gallons. The first two cans contained hot soapy water and the third a boiling rinse water. The procedure was changed in 1943 so that only the first can contained hot soapy water and the remaining two had boiling rinse waters. The change from a practice which had endured in the army for so many years required no little attention through education and demonstration. (Figure 10).

Much British equipment was used by troops in Great Britain in mess kit washing. Three 12 gallon Goyer stoves were adapted to the American procedure. This varied so greatly from American standards which provided three 25 gallon galvanized iron containers for 250 men, that scales were changed to provide three such cans for each 125 men.

Accumulated experience proved that three containers under either scale were insufficient for proper washing of mess gear and a modification was introduced whereby two additional containers were added. The first can was placed at the head of the mess line and used for sterilization of mess gear immediately before its use, a process which came to be known as the "pre-dip". The second was placed ahead of the soapy wash can in the washing line, contained plain water and was designed to remove coarse

food remnants, thus easing the load on the standard three cans.

Excessive loss of heat made it difficult to secure and maintain boiling water. The immersion type water heater which is easily the most practical heating arrangement was available to only a few ground force units. Regulations were revised permitting the use of the burners of steel ranges for this purpose.

Many units improvised burners that used gasoline as fuel, because of the shortage of British Soyer stoves and also of the United States field type range. (Figure 11). Most of the devices were of simple construction and easily dissembled for transportation, but had the disadvantage of danger from explosion when fired by personnel unfamiliar with the device.

The washing and disinfecting of dishes and mess kits was aggravated in many instances by the excess hardness of the water, inadequate facilities for heating water, and a shortage of cleaning supplies. Excessive hardness was mitigated through use of various water softening compounds, that known as "Gusto" being most efficient. Gusto was a non-caustic alkaline detergent containing sodium carbonate and sodium metasilicate. The chemical was added to the hot soapy wash in proportions of three-fourth of an ounce, about a tablespoonful, per gallon of water and did much to eliminate the gummy deposits and greasy film that formed as a result of the reaction between soap and the calcium and magnesium salts present in the water.

Chemical Treatment of Mess Gear.--Chemical treatment of rinse water was advocated and practiced when boiling water could not be obtained. Chlorine solution as prescribed in Field Manual 8-40 was first used, with one ounce of Grade A hypochlorite added to 25 gallons of water to give a concentration of at least 200 parts of chlorine per million. "Mikroklene" was subsequently recommended by the War Department. The package was of such size that when the contents were added to 25 gallons of water the resulting solution was deemed sufficient for disinfecting the utensils of 200 men for one meal. Chemical treatment was never considered a satisfactory substitute for boiling water.

Selection of Camp Sites and Camp Sanitation

The selection of camp sites on the continent was by necessity limited to tactical rather than sanitary considerations. (Figure 12). In the United Kingdom considerable latitude was allowed sanitary officers in respect to proper location of camps to the extent that factor affected the health and morale of soldiers.



Figure 10

Water for mess kit laundry is heated by an immersion heater in the bivouac area of an armored division, France, September 1944.



Figure 11

Improved mess kit laundry unit at the Medical Field Service School, England 1943.



Figure 12

Artillery men pitch their tents beside their "self propelled 105" - 7th Armored Division, St. Vith, Belgium, January 1945.

Camp and hospital sites were selected in the United Kingdom by representatives of the Medical Department, the Corps of Engineers and of the British Ministries of Health, Food, and Agriculture. Because Britain had to import the majority of her food supplies there was constant reluctance to devote land suitable for farming or grazing to military purposes. The general policy was to locate camps on land not suitable for other purposes. (Figure 13).

In the early days of 1942 when air raids were common during day light hours, much emphasis in the selection of camp sites was placed on cover and concealment. Located in wooded areas or on poorly sloping ground, troops and their equipment found difficulty in keeping dry. Lack of sunshine not only affected health but decidedly influenced morale. In the course of time and as control of the air by allied forces was established this became a less pertinent consideration.

Other considerations entering into the selection of camp sites pertained to drainage, water supply, prevalence of insects, rodents and proximity to civilian communities.

Camp Sanitation in Staging Areas.--The concentration of large numbers of troops in southern England just preceding the departure to Normandy brought special problems in camp sanitation. Never before and never thereafter were so many men crowded into such a small space. Each man was especially trained for a difficult assignment ahead and in the event he became a noneffective, replacement was not easy at that stage of military operations. Much stress was therefore placed on mess sanitation and personal hygiene. Commanding officers, cognizant of their responsibility, were held to strict account of violation of existing sanitary orders. Water supply and sewage disposal problems were more easily solved than those relating to mess sanitation, of which some of the difficulties have already been described.

Camp Sanitation on the Continent.--Despite the more difficult situation presented to troops by active operations, camp sanitation during the continental operation was consistently good. Repeated observations were made of the excellent condition in which troops left camp sites after bivouac for a day or two in an open field. The general behavior in the maintenance of environmental sanitation was a credit to the American soldier.

Camps for Displaced Persons and Prisoners of War.--The subject can be epitomized by stating that almost without exception there were too many people for the facilities available. (Figure 14) Prisoner of war camps fared well enough during the orderly progress of operations in France and in the early days in Germany. The difficulty came with the end of the war, when the number of prisoners overwhelmed existing facilities. The sanitary situation which then existed so often has been brought out in the discussion of the outbreaks of dysentery and typhoid fever which were a direct result.

The provisions that were made for displaced persons were always extemporized. In general, use was made of vacated German installations previously used for troops. Many were former casernes, far from modern and almost without exception tremendously overloaded. The problem was further complicated by the mixed population of men, women and children. Lack of sufficient military personnel to provide the necessary supervision served to aggravate the situation because most of the people living in the camps had been so unaccustomed to elaborateness in provisions that pride in environmental surroundings had largely disappeared.

Motor Convoys.--Some of the poorest practices in camp sanitation arose in connection with motor convoys. The long supply lines across France made necessary overnight temporary staging by drivers in the long trips from ports to the front. Men in permanent installations developed a pride in their surroundings. The same was true to a considerable extent of organized units however housed. It did not hold for motor convoys, in a camp for a night and rarely expecting to see that place again. Disposal of excreta was not in conformance with field methods and trash in the form of empty ration containers was indiscriminately discarded along the route. The Preventive Medicine Service was instrumental in initiating improved conditions in sanitary arrangements of convoys in road movements.

Sanitary Surveys

The Advance Section, Communications Zone, followed closely upon the Armies as they proceeded across the continent. As the first Communications Zone unit to enter liberated or occupied territory, this organization had the obligation to stabilize and organize conditions for the permanent Base Sections that followed, for the Advance Section continued to move forward in support of the field Armies. The Advance Section performed these functions for the First, Third, Ninth, and Fifteenth Armies and the Continental Advance Section for the Seventh Army.



Figure 13

Lobscombe Corner Camp, Wiltshire, England, July 1943.



Figure 14

Prisoner of War Enclosure at Langenzenn, Germany,
May 1943.

A principal part of the duties of these two organizations was to perform sanitary surveys of the principal communities occupied. These cities and towns were the future centers of troop concentrations. The justification for the survey was the need to know what health hazards existed and what health problems might be anticipated.

A certain indefiniteness about health conditions always existed when any army arrived in a new locality. All possible information had been collected by the Medical Intelligence Division of the Office of the Chief Surgeon during the long period of preparation preceding D-Day, but only inspections on the spot gave a clear idea of conditions. Only actual survey determined the extent to which health hazards had been increased as a result of physical destruction and disruption of public services.

Sanitary surveys were desirably made prior to the arrival of troops assigned to permanent occupation, in order that knowledge of necessary action might be promptly in their hands when they arrived. This was not always possible because troop locations sometimes had not been determined but many times it was possible to anticipate that certain cities would house appreciable concentrations of service troops. In the course of this work some forty surveys were performed in France and Belgium prior to 1 December 1944. In the rapid developments that took place during the remainder of the war the number appreciably exceeded a hundred.

The responsibility for preliminary sanitary surveys was assigned to the Preventive Medicine Division of the Office of the Surgeon of Advance Section. Ordinarily they were made by officer teams, consisting of an epidemiologist and a sanitary engineer. Information was collected on the general physical conditions of the area and on the particular parts which had been occupied by military forces. Special attention was given to water supplies, facilities for waste disposal, and to bath facilities. Data were collected on insect and rodent problems, on food and nutrition and on the presence of communicable diseases.

Information was obtained from a variety of sources, but civil affairs detachments and town majors were always visited on arrival in a new town. The Hotel de Ville was next visited in order to meet the civilian officials and gain detailed facts about the sanitary facilities of the community. Depending upon the size of the town, calls were made on the major, the chief of public works, director of water service and the director of public health. These officials proved to be uniformly cordial, cooperative and helpful

and either accompanied the officers or arranged for them to be guided on a tour of inspection.

Each city presented a different situation and often special information was required from other sources. For a town of less than 50,000 population, all of the required information could usually be obtained in a single day. Larger cities required more time for an adequate survey. The maximum use had to be made of the few hours at the disposal of the inspecting team, with schedules arranged so as not to require an interview with municipal officials between 1200 and 1400 hours.

The first stage in the study of any community was to obtain a broad general idea of the area, including topography, population, industry and the degree of war damage suffered. As would be expected the sanitary problems in port cities were usually more acute than those in market towns and the industrial cities of Northern France and Belgium presented different problems than those encountered in Normandy.

Information was secured on the number of United States troops located in the town, the nature of their quarters or bivouac and the estimated troop strength. The proposed future troop strength could rarely be predicted with any degree of certainty and the surveying officers were forced to the most unfavorable situation and to make their recommendations accordingly.

The public water supply was the subject of the most thorough investigation. As in the United States, ownership of the water supply system was sometimes municipal and at other times private. The sources varied from rivers to shallow wells and in Northeastern France and Belgium springs and infiltration galleries were most common. Treatment of the water supply varied markedly. The most common defect was the failure to chlorinate adequately. Only exceptionally could a chlorine residual be determined in water from the distribution system. Bacteriological analyses when performed differed in procedure and interpretation compared with United States standards and the results were not always helpful in evaluating the quality of water. So few water systems showed an approach to the standards adopted for the theater that hope of rehabilitating them sufficiently for use by Advance Section troops without significant alterations was usually abandoned.

The sewerage system was investigated in each community. Combined sewers were almost universal, carrying both sewage and

storm water. Of the towns surveyed, only three of forty made any attempt at sewage treatment. The disposal plant of one of these had been damaged and was not in operation; a second practiced sewage irrigation, while a third used sedimentation tanks. The normal procedure was to discharge the raw sewage into a nearby stream untreated. Very few cities were completely serviced by a public sewerage system. Cesspools, septic tanks, bucket latrines and common privies were found in varying numbers in different sections of the country.

Barracks and schools to be used by American troops were commonly equipped with septic tanks or cesspools. A practical problem always to be anticipated was how to get them desludged. In some parts of France every town had a vidangeur who in normal times contracted for cleaning and desludging of cesspools and septic tanks. Whether such a contract was available or not always had to be determined. In some localities field type latrines were recommended as the best expedient. In others, ordinary pit latrines were not feasible because of the nature of the soil and bucket latrines were recommended. In this event, satisfactory methods of disposing of the bucket contents had to be found.

Garbage and trash disposal readily become a sanitary hazard where large numbers of troops are stationed. An effort was made to anticipate such a problem by selecting in advance a satisfactory method of disposal. Municipal incinerators in an operational condition were rarely found. The most popular method was to use garbage and litter in making sanitary fills. Before recommending a dumping ground, the site was inspected. The better sites were maintained by civilian employees who raked, leveled and covered the organic matter in the dumps. Only those so remote as not to be a nuisance were recommended for military use.

Bathing facilities were surveyed in each town. Although it was not the function of the Medical Department to provide shower and other bathing facilities it was their responsibility to inspect such installations. In some areas Quartermaster Corps operated shower points were provided. In others existing public baths and showers were used, of which some were operated in a sanitary manner and some were not. In Belgium two of the principal cities were found to have modern natatoriums with equipment for treatment and recirculation of water.

The possibility of insect and rodent problems was always considered in each of the sanitary surveys. Fly breeding was a problem to a moderate extent in some coastal areas. Yellow jackets were a nuisance to the troops in the field during warm weather. Rats were observed but never became a serious menace.

Food was scarce even in rural communities except for items produced locally. Sugar was scarce in Normandy and fats in northern France. Rationing was everywhere strict particularly in Belgium, but nowhere was starvation encountered and for this the credit was generally given by the informant to the black market.

Communicable disease among civilians was carefully investigated. The long period of German occupation, poor communications and indifference had resulted in very meager and inadequate reporting of communicable disease in most of the towns and cities visited. Where records were available a high incidence of intestinal disease was usually determined. Diphtheria had been endemic in all communities and epidemic in many. Intensive campaigns for the active immunization of children had in the past year brought this disease reasonably well under control, even though the rates remained far higher among adults than were common in the United States. Scabies increased as the soap supply diminished. An attempt was made to trace to their source cases of typhus occurring within the previous year. On several occasions illnesses reported as typhus were found to have been typhoid fever. Information on the prevalence of prostitution and of the venereal diseases was not included in the sanitary survey since a separate venereal disease survey was made where indicated.

The recommendations which concluded the reports of the sanitary survey were worded in such a manner as to apply to unit commanders of troops in the particular town or city. The most common recommendations were the prohibition of the use of water from the public supply for drinking or culinary purpose without further treatment; in respect to disposal of excreta and other wastes; explicit directions for the use of existing dumping ground for garbage and trash; and the use of public baths and showers. Special recommendations were added in some reports, such as the use of bathing beaches in one coastal area.

The reports of sanitary surveys were forwarded through command channels and information copies were sent to other services concerned. Where there was an area commander he received a copy. Copies were also transmitted to the appropriate Base Section to assume command when the area was released from control of the Advance Section.

The Monthly Sanitary Report

A report to be submitted routinely by units engaged in active operations in the field must have demonstrated merit to warrant its justification. The monthly sanitary report rendered by Surgeons of each separate unit was always considered a necessary part of operations and an essential source of health information. While the reports were sometimes stereotyped and lacked interest, the majority contained facts of value in solving existing problems, in planning operations and in anticipating developments.

The sanitary report was a document transmitted through command channels and consequently was slow in arriving at the headquarters level. The delay was many times so great that it failed in the purpose for which it was originated, which was to act as a corrective agent. To overcome this deficiency a procedure was adopted early in 1943 whereby a carbon copy of the report was sent directly to the Office of the Chief Surgeon in addition to the regular report which followed through channels. It was understood that this information would not be used as a basis for official action but merely as a method for gathering information. It did lead to a well developed concept of general theater problems and permitted the extent of common difficulties to be determined at a time when remedial action could be undertaken to advantage.

An individual record card was maintained in the Sanitation Branch of the Division of Preventive Medicine for each unit of the theater, on which note as made from material derived from the Sanitary Report of sanitary deficiencies or undue prevalence of communicable disease. Formal recommendations made when the official copy of the report was received were likewise recorded. If satisfactory action did not follow or if conditions failed to improve, field investigations were instituted either directly from theater headquarters or through Divisions of Preventive Medicine in base sections or other major commands of the theater to determine the reasons for failure or to stimulate action.

Analyses were likewise made of theater practices in sanitation, to determine prevailing levels of accomplishment and fluctuations in results. For example each unit gave the results of the monthly bacteriological analysis of the water supply. Not only was this of value insofar as the particular

supply was concerned, but cumulative data demonstrated the trend of accomplishment in management of water supplies throughout the theater. The same system was employed with respect to other features of environmental sanitation and hygiene, and also for prevalence of the communicable diseases.

When action by other agencies of the military organization was required, or recorded items were of general import, the sanitary report was circulated to the appropriate division of the Office of the Chief Surgeon or to other arms and branches of the service. Matters most commonly concerning the Corps of Engineers had to do with housing, bathing, water supply and sewage disposal. The Quartermaster was the responsible authority in a position to take corrective action for affairs connected with food, clothing, sanitary supplies and fuel.

Material contained in the Monthly Sanitary Report was often of general value and interest and formed the basis for articles on sanitation and descriptions of new devices which were published in the monthly Medical Bulletin of the Office of the Chief Surgeon for dissemination throughout the theater.

During the course of operations a report resembling in some essentials the Monthly Sanitary Report but containing more detail of professional interest came into being as a monthly report to the War Department. This was the Essential Technical Medical Data report. The need for it developed from long delay of the ordinary sanitary report in transit to the Zone of Interior. The Monthly Sanitary Reports from units of the theater were a common source of material for the report.

Rodent Control

The American forces in Britain were largely relieved of the responsibility of rodent control by reason of the energetic program of extermination maintained by British authorities through the course of operations.

The British interest in rat control arose more from the need for food conservation than for control of communicable diseases. The Ministry of Food, the Ministry of Agriculture and the Ministry of Health joined in a comprehensive campaign against rats in most of the principal cities of Great Britain. Great stress was placed on public health education with popular campaigns and instructions to farmers and others in methods of combating rodents. Zinc phosphide was the principal rodenticide employed, although red squill

was also used, but to a limited extent because of the difficulties of supply. American Medical Officers in North Ireland encountered a novel method of attack on rats which made use of ferrets and dogs. The organization of this method had been brought to a high level, but was scarcely suitable for military practice.

Because of the general program of rat extermination, relatively little difficulty was experienced in American military installations in respect to rats. Measures were instituted by military authorities as circumstances required, but more commonly the local rat extermination team of the county was called in aid. Instructions were issued by the theater that authorities of all American military installations were to cooperate with the organized British effort. American personnel commonly made use of barium carbonate and trapping, but the joint effort was more commonly an application of the British method.

As minimal as the rat problem had been in the United Kingdom, conditions on the continent were even better. The Monthly Sanitary Reports rarely mentioned the presence of rodents and no report from any source came to headquarters of an undue prevalence of rats, even in port areas. Local situations occasionally demanded the attention of commanding officers but as a theater problem rodent control did not enter into consideration.

Insect Control

Provisions for the control of insects were among the earliest preventive measures established in the European Theater. Medical entomological problems in the European area were not as numerous as those in subtropical and tropical areas, but laxity in recognizing and controlling the major difficulties which did exist could well have been disastrous to military operations.

The principal effort was in louse control. The care with which methods were developed and the plans made for putting them into action were evidenced by the very favorable results obtained in the control of a serious outbreak of typhus fever in 1945.

The second major concern was that of mosquito and malaria control. The part that the entomological service placed in the control of these two important communicable diseases has been presented in detail in previous discussions. Opportunity will be taken here to discuss some of the minor

problems in insect control, the development of technical methods for insect control and to outline the procedures which became standard practice in the theater.

Insect problems of the British Isles.--Entomological problems during the time that troops were stationed in the United Kingdom were of a minor nature. Flies were prevalent in many localities to the extent that they created a nuisance. In the first year of the theater screening materials were not procurable and insecticidal sprays were available only in small quantities. That flies constituted a problem in England was not admitted by local health authorities. That they were present in many camps was evident by comments in sanitary reports. As the theater developed, screening was provided for buildings concerned with food preparation and mess halls with the result that the latter years in Great Britain saw improved conditions.

Other than for sporadic infestations of pubic lice the troops were practically free of pediculosis. Periodic checks were made of troops newly arrived from the United States to determine whether infestations of lice and scabies were being contracted on board transports. No infestation was found among the troops examined.

Investigation and assistance in the control of minor local outbreaks of roaches, bedbugs and harvest mites constituted the principal field activities.

Insect control on the continent.--The entomological service in the Preventive Medicine Division came into its own with the onset of active field operations, beginning with the first days of the campaign when problems of mosquito control developed in Normandy. Mosquito control continued an active interest throughout the course of activities. The nature of the problem and the methods employed are to be found in the discussion of malaria.

The first indication of need for attention to the problems of infestation with lice came to the fore in the lull in fighting which preceded the November offensive. Isolated instances of louse infestation were reported from field armies, the circumstance of greatest extent involving some 100 men. This experience brought a request for attempted development of louse-proof underwear for combat soldiers because of the difficulty of keeping troops supplied individually with anti-lice powder. With limited materials obtained from British stocks experimental trial of the method was undertaken among soldiers of the Ninth Army but on too limited a scale to come to definite conclusions.

A survey of 1800 units in December and 1500 others in January including men of 23 and 44 divisions respectively, showed that about 0.5% of units gave some evidence of infestation with body lice but the total number of individual infestations in all units was less than 100. The infestation usually occurred in combat troops who had slept in quarters recently vacated by German soldiers or civilians.

The great value of the educational work on louse control was exemplified by the fact that the few infestations which did appear among combat troops were quickly eradicated and only rarely did the same unit have infestations in successive months. These surveys during the winter months served to assure that when typhus appeared in areas occupied by American troops, no great danger of an epidemic of typhus need be feared because of the presence of such a low level of infestation.

The real test of the methods which had been developed and the educational measures which had been practiced in respect to American troops came with the development of typhus fever in early March 1945. Despite residence and operations in an area with thousands of cases of typhus fever the United States Army practically escaped infection. The activities of the entomological service in the important feature of typhus control centering in the elimination of lice, has been discussed in the presentation of control measures used against typhus fever.

The control of insects.--The many newly developed materials for the control of insects which came from the experience of the war served to introduce material changes in the course of operations, into practices which were followed in the European Theater. In 1942 the entire emphasis in louse control was on methyl bromide fumigation and on MYL powder. Subsequently DDT powder became available and the whole procedure for louse control underwent fundamental change. The applicability of these materials to mosquito control soon became apparent and they were liberally applied in that field. The practical control measures now to be presented represent practice at the close of operations in the theater.

Control of human lice.--Three species of lice attack man, namely the body louse, the head louse and the crab louse. Because of the wide differences in habit, each species requires special consideration in applying control measures.

Body Lice.--The body louse usually spends its life in the clothes. Accordingly in looking for body louse infestation, the clothing was examined along the seams and folds and especially on the inside of the underwear; and control measures were directed largely toward the treatment of clothing. Louse powder with a principal component of DDT was the method of choice. The powder contained 10% of this chemical in an inert carrier. It was available in two ounce sifter top cans for use by the individual and in bulk for application to large numbers of persons by means of mechanical dusting equipment.

Application by individual.--Powder from the sifter top cans was sprinkled over the entire inner surface of the underwear with special attention paid to the seams. As the powder was applied it was rubbed in evenly with the hands. The seams on the inside of the shirt and trousers were treated in a similar manner. Approximately one ounce of powder was used for one application. The treatment was highly effective and complete lethal effect on lice was usually expected in 24 hours. The powder does not destroy eggs but remains effective sufficiently long to kill the young lice as they hatch, and one application usually eradicated an infestation. Since the lasting effect of the powder was due to residual action of the powder remaining on the treated clothing it was necessary to reapply the powder when the underwear was changed. If a general infestation was detected every individual of the unit was treated at about the same time and powder was also dusted into the bedding between the sheets and blankets and in the mattresses. Persons not infected but mingling with leusey troops or civilians or living in infested quarters were required to apply the powder in the manner described as a prophylactic measure. Soldiers in the field often found it impractical to remove their clothing for treatment. In this case good results could usually be obtained by unbuttoning the shirt and trousers and dusting the inside of the underwear, shirt and trousers with the powder.

Mass Treatment of Individuals with Dusting Equipment.--When it was necessary to delouse large numbers of persons, bulk DDT powder and insecticide dusting powder were used advantageously. The procedure involved the following steps. The powder compartment of the duster was filled about three-fourth full of louse powder and the duster was always used with the delivery tube on the upper side. In using the duster the operator took particular care that the powder was distributed on the inner surfaces of the inner garments and on the skin itself. The seams of the clothes, about

the neck, arm pits, waist and crotch were emphasized as being particularly important. Approximately one ounce of powder was required per individual.

This routine was suggested to avoid missing parts of the clothing: In the course of dusting the subject stood facing the operator with arms extended. The nozzle of the gun was inserted under the clothing next to the skin at the wrist and powder was pumped up the sleeve to the shoulder, and the operation was repeated on the other arm. The nozzle of the gun was inserted at the waistline of males next to the skin and powder directed toward each hip and the pubic area. The subject faced about and the dusting operation was repeated at the neck and waistline. Females were treated in the same manner except that waistline dusting was not required. The hair on the head was dusted last. If a head covering was worn it was not removed but the nozzle was inserted underneath and the dust applied. If no head covering was worn the dust was pumped directly into the hair. In most instances the hair was ruffled in the hands to distribute the powder. If overcoats were worn, they were dusted lightly on the inside particularly about the arm pits.

Control by use of spray on body and fumigation of garments.--In some situations it was desirable to eliminate all lice present on groups of individuals, hospital patients or prisoners within a short period. This was done by spraying the individuals with delousing insecticide spray, and destroying lice and eggs in garments by methyl bromide fumigation or steam sterilization. The delousing spray was either an emulsion concentrate diluted with water, using five parts of water to one part of concentrate, or an alcohol solution. Both types were effective and were used in the same manner. The application of delousing insecticide spray for the control of lice and scabies was done by trained personnel of Quartermaster delousing units or the Medical Department.

The delousing of individuals was accomplished by stripping the individual and while the clothing was being deloused, the person was given the spray treatment. The spray was applied by means of a sprayer (liquid, insect, continuous spray) or a power sprayer with a paint spray nozzle, to the pubic and anal regions, under the arm pits and on the other hairy portions of the body. It was also applied to the head for the control of head lice. During the application

the individual held his fingers over his eyes to prevent the spray from getting into the eyes or under the eyelids. Individuals were not permitted to bathe for at least 24 hours after treatment. The treatment destroyed lice and eggs and the residue destroyed any escaped lice for from several days to a week after treatment. About 50 cc of spray was required for the treatment.

Delousing Garments.--Lice and eggs can be destroyed by the usual methods of steam sterilization or by the use of methyl bromide ampules in delousing bags. Especially trained details should perform this work since high concentrations of the gas are dangerous. Exposure to low concentrations for short periods is not dangerous. Methyl bromide should be used only out of doors or in a structure without side walls. It will not injure clothing and equipment. The times required are: at temperatures of 60° Fahrenheit or over, three-fourths of an hour; at 50 to 59° temperature, one and a quarter hours; at 40 to 49°, one and three-quarter hours; and at -9 to 39° the required time is two and a quarter hours.

Fumigation by this method requires that a numbered fumigating bag and corresponding numbered identification tag be issued to each individual to be deloused. A duplicate tag was placed inside the fumigating bag. The operator inserted an ampule of methyl bromide and closed the bag. The ampule of methyl bromide within the closed bag was broken and the bag allowed to lie on its side for the prescribed time. The bag of fumigated clothing was then opened in the presence of the owner and emptied on the ground, personnel standing to windward at all times. After airing for five minutes each garment was shaken out thoroughly before being worn. A vault method utilizing a gas tight chamber was available for large scale disinfestation of clothing and equipment. Operation of the above required especially trained technicians and was done by the Quartermaster Corps.

Head Lice.--The presence of suspected presence of head lice was readily revealed by examining the hair for eggs or nits. They were destroyed by use of delousing sprays or powders. Delousing insecticide spray was applied with a sprayer or by hand. About 10 ml. to 15 ml. was required per person depending upon the amount of hair present. The material was applied as evenly as possible and thoroughly rubbed into the hair, since the eggs had to be contacted in order to be killed. The material was removed when the hair was washed in soap and water. The treatment destroyed all lice within a few hours, but preferably was allowed to remain in

the hair for as long as possible to prevent reinfestation from eggs in bedding, headgear and clothing which might hatch during the two weeks following treatment. The treatment was used as a preventive by persons doing delousing work or by troops mingling with infested natives, by applying the material at intervals of about two weeks.

The louse powder was also effective against head lice. It was thoroughly dusted into the hair and rubbed in with the hands. The hat or other headgear was also dusted. The eggs were not killed by the powder so a second treatment was made one week to ten days later. The head was not to be washed for at least 24 hours after each treatment and preferably the powder was allowed to remain in the hair to aid in preventing reinfestation.

Crab Lice.--The same treatment recommended for head lice was also used effectively against crab lice. It was highly important that the material be applied thoroughly. Since infestations were frequently very general over the entire body, especially on hairy individuals, treatment was applied not only to the pubic regions and to the arm pits, but to the trunk, back, leg and arm areas where hair was present.

The powder was sprinkled on the body and distributed by rubbing with the hands. About one ounce was required per treatment. Bathing was avoided for 24 hours. A second application was made after seven to ten days.

The delousing spray or liquid preparation was also used, thoroughly covering the body and allowing the material to remain for 24 hours. It was applied with a sponge, a piece of cotton, by hand or by means of a sprayer. About 40 ml. to 50 ml. was required for treatment and one treatment eliminated the infestation if all eggs were contacted with the material. The delousing sprays, particularly the emulsion type, were also effective against scabies. One application was effective and no bath was required.

Control of Adult Mosquitoes, House Flies, Bed Bugs, Fleas and Cockroaches.--DDT residual insect spray was used in controlling insects by leaving a residual insecticidal deposit on the walls and ceilings and other places where insects came in contact with it. It remained effective for several weeks and perhaps months after treatment. For this reason it was usually not necessary to apply the residual sprays oftener than about once a month.

Methods of application.--Residual effect DDT insecticide spray was the prepared residual spray stocked by the Quartermaster and was recommended for general use. A similar spray could be

made by dissolving delousing larvicide DDT powder in kerosene or diesel or fuel oil when staining was not objectionable. A concentration of five per cent., about 7 ounces per gallon, was normally used. The solution was applied as a wet spray, giving the surface a thorough covering, but not applying so much that it ran off the surface. Hand sprayers were used for small areas. Knapsack type sprayers were used, but the nozzle should be adjusted to make a fine spray. Care should be taken to avoid such a fine adjustment that a mist forms. A disc opening the size of a No. 60 standard wire gauge is suggested. Power sprayers were used in the same manner. The ordinary paint spray nozzle produced too fine a mist and most of the spray fell to the floor or escaped into the air. If this was the only nozzle available it was held close to the object to be sprayed in order that the liquid would remain as a spray deposit.

Insecticide DDT emulsion concentrate, an aqueous emulsion, was sometimes used instead of the DDT kerosene solution. The same equipment and method of application was used. One part of concentrate to four parts of water produced a 5% DDT spray and was the recommended strength for most purposes. The use of insecticide DDT emulsion concentrate was authorized only for the disinfection of clothing for the control of body lice.

Pests for which residual sprays are suggested.--The spray should be applied as protection against mosquitoes to the inside of dwellings, barracks, tents, latrines, mess halls and dugouts, under bridges and to any resting place for mosquitoes within the camp site. This may include the entire inside of the dwelling, especially in the darker places, such as under beds and behind objects and in corners; screens, if present, should be treated, preferably, by means of a paint brush. One quart will cover 250 to 500 square feet.

For house flies the DDT residual spray should be used where the insects are concentrated. The interior of mess halls and kitchens, including the inside and outside of window screens and screen doors, latrines, garbage racks and other favorite resting places should be sprayed or painted. Both the inside and outside of latrine boxes should be thoroughly sprayed. To prevent fly breeding, residual spray should be applied to the fecal matter in the latrine pit at the rate of 2 ounces per latrine box hole or 1 ounce per 2 square feet of pit surface. 10 percent. DDT powder can also be used to prevent fly breeding in latrine pits by using 1 ounce per box hole or 1 ounce per 4 square feet of pit surface. The liquid or powder should be applied twice weekly at first until local experience reveals how often application need be repeated.

Bed bugs.--The spray was applied to beds and into the cracks and crevices in walls. In treating beds it was important to get complete coverage of the entire mattress and bedstead. The spray was directed particularly to the springs, joints and corners of the bedstead. Dark walls were treated to a height of about six feet with special attention to cracks and crevices. One treatment destroyed an infestation and prevented reinfestation for several months. Where the spray was not available, effective control was obtained by applying the DDT louse powder to the bed, bedding and cracks in the walls.

Fleas.--The spray was applied to the floor and about two feet up on the walls for the control of fleas in buildings. In living quarters a light spray should also be applied to the beds and bedding. One gallon of 5% DDT in oil served to treat an area of from one to two thousand square feet. DDT louse powder was also used successfully.

Cockroaches.--DDT spray applied thoroughly in mess halls and kitchens gave promising results in the control of cockroaches. However, information on the value of the spray deposit and duration of effectiveness was not fully determined. The DDT louse powder applied to favored hiding places of roaches, such as crevices and behind objects, proved an effective means of control.

Aerosol Insecticide Dispensers.--The one pound aerosol insecticide dispenser provided an effective and convenient method of destroying mosquitoes in tents, barracks, billets and other somewhat confined spaces. When possible the use of aerosol bombs in trenches, fox holes, bomb shelters and similar locations by front line troops was recommended, and such bombs were reserved primarily for such purpose. Directions for application were stamped on the bombs, and, since the bombs were frequently used in excessive amount, it was urged that such directions be carefully followed. The bombs were also used to destroy mosquitoes in small outdoor areas such as around gun sites. This was done by releasing the aerosol as the operator walked back and forth in the area being treated. It should be released as close to the ground as possible, making swaths approximately 20 feet wide. One bomb was sufficient to treat an area of from one to two acres.

DDT Larvicides for Control of Anopheles and Other Mosquitoes.--DDT proved to be a very effective mosquito larvicide. Small quantities of the material controlled mosquito larvae over large areas. It was used as a dust with inert diluents, in liquid form dissolved in oils or other solvents, or in an aqueous emulsion. It was highly effective against both anopheline and culicine larvae.

Control of Anopheles Larvae.--Preparation of petroleum oil solution of dissolving larvicide DDT powder was accomplished by adding this commercial grade of DDT in crystalline form to oils. At ordinary temperatures it dissolved in oil rather slowly. It was, therefore, advisable to keep a reserve stock of such mixtures on hand. A 5% solution was prepared by adding DDT at a rate of 2 pounds for each 5 gallons of oil. Unless such heat as that provided by the exposure of the drum in sunlight was used to hasten the action, as long as 24 hours was required for the DDT to go into solution. Kerosene, diesel oil, fuel oil, or crank case oil dissolved the material. This concentrated solution was applied directly where coverage could be obtained with small quantities of oil, or it was used to make dilutions of the desired concentration.

Application.--The material was poured or used from squirt guns. This method consisted of applying oil containing DDT to the water surface in the simplest manner possible. The oil was applied at different places to the pool or stream and the dispersion of DDT was dependent upon the spreading properties of the oil. Waste crank case oil was used, but diesel oil or fuel oil was recommended. The quantity of oil containing DDT needed per acre of surface was dependent upon the amount of vegetation and debris and on the area over which the oil would spread. It killed the larvae when present as a very light film. When the oils used spread readily, as little as one to two quarts of oil, containing 5% DDT per acre, was effective if applied at a number of points over the area. In some breeding areas oils did not spread sufficiently to make this method reliable.

Spray equipment was considered most reliable under a wide range of conditions. Owing to the remarkable toxic action of DDT the amounts needed were extremely small. This must be realized to take full advantage of the potential saving in material and labor. Whereas oil alone was usually applied at the rate of 15 to 35 gallons per acre in mosquito control operations, equally or more favorable control was obtained with 1% DDT oil solution properly applied at a rate of approximately 5 quarts per acre. With a 5% DDT solution, even amounts as small as one to two quarts per acre were effective, if coverage could be obtained by using a low delivery of fine mist. With the type of spraying equipment usually available, it was necessary to use a lower concentration and larger quantities of spray. The spray nozzle should be adjusted to liberate as fine a spray as possible, and at a slow rate, and the spray applied so as to obtain as much drift over the water as possible. A swath width of 50 feet was suggested, although this varied with the fineness and the wind velocity. By changing the aperture of decontamination sprayer discs

to about $3/64$ ths of an inch (56 to 60 standard wire gauge), the delivery rate of standard spraying equipment was reduced and a finer spray was obtained. For residual toxicity, where wind and waves did not affect the surface, a dosage of one pound of DDT per acre was used. For this dosage two and one-half gallons of oil, containing 5% DDT, was required.

Aqueous Emulsions.--Insecticide DDT concentrate emulsions were used as mosquito larvicide. It had the advantage that it merely had to be diluted with water to the desired concentration, thus simplifying the supply problem. The material had a tendency to remain concentrated on, or to rise to, the water surface when it was sprayed as a fine mist. A mixture of one part concentrate to four parts of water gave a 5% DDT spray. Application was the same as with oil sprays. For initial kill a dosage of one-tenth of a pound of DDT per acre was recommended. At this dosage one pint of concentrate controlled anopheles larvae on two and one-half acres of breeding area.

One part of DDT to a million parts of water in quiet pools prevented breeding for several weeks. This dosage required approximately 11 pints of the concentrate per acre of water one foot deep. In applying heavy dosages concentrate was diluted to the desired concentration of DDT and applied as a coarse spray, which tended to cause the spray to mix throughout the water. Dosages higher than one part of DDT to ten million parts of water may prove fatal to fish life, and were not normally recommended. In situations such as temporary pools, shell holes and barrow pits where fish life was not present heavy applications of DDT were recommended in order to reduce the frequency of application.

Dust Form.--Control of anopheles larvae can be obtained with one-tenth pound or less of DDT in dust form per acre. This material, listed as DDT dusting larvicide powder, contained 10% DDT in an inert diluent. It was applied at a rate of one pound per acre, but to get effective distribution it was sometimes necessary further to dilute the larvicide with any inert dust. Five pounds per acre of a 2% dust proved satisfactory in most situations. Residual action was obtained in quiet breeding areas where vegetation was dense with the application of one pound per acre.

Other Methods of Application.--The methods of application of DDT larvicide suggested above were the most common. However,

various methods may be employed. DDT in oil solution or aqueous emulsion may be used in drip pans. Fine sawdust or other materials treated with oil containing DDT for broadcasting of the larvicide in the same manner as that used for paris green-oil combinations may be effective.

Use of DDT Against Culicine Larvae.--The materials and methods of application already discussed gave satisfactory control of various species of culicine larvae. However, heavier dosages of oil solutions were recommended, such as the dosage per acre of one-half pound DDT in an oil solution. In using the aqueous emulsion, surface applications of from one-tenth to one-fifth pounds of DDT per acre for a dosage throughout the water of at least 0.05 parts per million was recommended. Applications of DDT as a dust were not highly efficient against culicine larvae which feed below the water surface, and such method was not recommended.

Repellents for Mosquitoes, Biting Flies, Fleas, Mites and Ticks.--Two ounce bottles of insect repellent may represent any one of several chemicals or a mixture of them. The method to use is the same, regardless of the composition of the material.

Mosquitoes.--The material was applied to the skin by shaking into one hand one-half to one teaspoonful of the repellent. The hands were rubbed together and the repellent applied in a thin layer to the face, neck, ears, hands and wrists. The repellent must be uniformly distributed over the areas to be protected as the insects will seek out and bite the areas where the application is too thin, or where the material has been rubbed off. Care should be taken not to apply the material too liberally on the forehead as it causes a stinging sensation if it gets into the eyes.

The repellent gave protection for from one to five hours, depending upon a number of factors, such as the rate of application, the species of insect involved, the relative humidity, the amount of perspiration, and the rubbing of treated areas. There was also an unexplained variation in effectiveness among individual users. The repellent was a solvent of paints and varnishes, and of many of the plastics, such as watch crystals and synthetic cloth, and was to be used with caution where these materials were present.

Repellent applied to clothing repelled insects for a number of days. Trousers, shirts, socks, gloves, headnets and bednets were treated. Under field conditions, where no mechanical equipment was available, thorough protection was obtained from hand application.

About 12 drops of the repellent should be shaken into one hand, the hands rubbed lightly on socks, shirts, or trousers, where bites occur.

Hand or power sprayers were used to obtain more even distribution. A power spray is preferable. Two or four ounces should be used per suit. Men can be sprayed with the clothing on, with care that they protect their eyes and do not breathe sprayed material. Clothing may be sprayed after being removed, in which case the garment should be turned inside out and buttoned. One man can hold shut the opening of the sleeves and neck of the shirt, and bottoms of the legs of the trousers while another sprays into the bag-shaped garment.

Fleas, Mites, and Ticks.--For use against fleas, the repellent was applied to exposed skin and to clothing in the manner described above for mosquitoes. While it did not prevent fleas from alighting, the fleas left the treated surface almost immediately and did not bite.

Repellent acted also against mites. It was applied to the skin of the legs and arms, but was most effective and longer lasting if applied to clothing. This was done as described for mosquitoes, but the simplest method was to draw the mouth of the bottle along the cloth, applying a thin layer one-half inch wide along all openings of the uniform; inside of neck, fly and cuffs of shirt, waist, fly and tops of trousers; socks above shoes; and all edges of leggings. Clothing was treated several days before it was worn, and one application was effective until the uniform was normally changed for laundering.

In protection against ticks the repellent was applied as a spray at the rate of three to four ounces to the entire outer garment. It was highly effective against immature ticks, but less effective against adult ticks.

FIGURES

1. Elevated water tank build by British Contractors for U. S. Forces, England, January 1943.
2. Field demonstrations of pump and filter units of a portable water purification apparatus, England, December 1942.
3. A portable purification unit and settling tank is operated by the 1142nd Engineer Group, Ninth Army, at Gulpen, Holland, March 1945.
4. German Prisoners of War waiting to draw water, Germany, April, 1945.
5. A water tower near the front lines, Haguenau Area, France, in January 1945.
6. Testing beer before distribution to First Army troops in Belgium, November 1944.
7. Feces incinerator, British design, England.
8. Sewage Disposal Plant under construction by British contractor, England, January 1943.
9. Sewage Disposal Plant at Langford Ledge, North Ireland, January 1943.
10. Water for mess kit laundry is heated by immersion heater in the bivouac area of an armored division, France, September 1944.
11. Improvised mess kit laundry unit at the Field Service School, England 1943.
12. Artillery men pitch their tents beside their "self propelled 105" - 7th Armored Division, St. Vith, Belgium, January 1945.
13. Lobscombe Corner Camp, Wiltshire, England; July 1943.
14. Prisoner of War Enclosure at Langenzenn, Germany, May 1943.

A HISTORY OF PREVENTIVE MEDICINE
IN THE
EUROPEAN THEATER OF OPERATIONS
UNITED STATES ARMY
1941 - 1945

PART X - Military Occupational Hygiene

by

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PART X

Military Occupational Hygiene

The conception of military occupational hygiene as incorporated in the program of preventive medicine in the European Theater was in analogy with the activities generally included under industrial or occupational hygiene in civilian practice. It was concerned with the disturbances of physiological hygiene in the individual that occur under military conditions, especially in relation to clothing, personal equipment and through the operation of mechanized and other military equipment. It dealt with the personal health hazards of military life which arose as a result of an occupation as a soldier. The Military Occupational Hygiene Branch of the Division of Preventive Medicine, Office of the Chief Surgeon, ETO was activated in July 1943.

Military organization in preventive medicine gives full consideration to the community aspects of the prevention of disease and the maintenance of health. Environmental hygiene has probably reached its highest development under military conditions. The control of the communicable diseases has likewise received strong emphasis in army programs of prevention. The record of accomplishment has been uniformly good, and the contributions made to progress in the field have been outstanding. The current military activities saw nutrition come into its own. Perhaps the major criticism to be made of preventive medicine in the United States Army is that too little attention is directed to the problems of the individual soldier. The community aspects have received full attention.

Comment has already been made on the progress that the Air Force has made in relation to the health of the individual soldier. The Occupational Hygiene Branch in the Office of the Chief Surgeon was established in an effort to bring greater theater emphasis to the field.

Functions and Policies.--The functions and policies of the Occupational Hygiene Branch are more difficult to express with preciseness than those of most parts of the Preventive Medicine program, by reason of the fact that the objectives in this field aim at an individualized contribution rather than to community attention to health matters. To an extent, purposes and aims can be formalized, because prime fields of endeavor do exist. A principal part of the work has to do, however, with functions frequently considered **inconsequential** and therefore often neglected, but none the less bearing importantly on health, welfare, and morale.

In functional charts of the Division the guiding principles were stated as follows: (1) To collaborate closely with the Corps of Engineers in the provision of adequate housing of troops, with

special attention to scales of accommodation, heating, and bathing and ablution facilities. (2) To provide consultation and technical aid to the Quartermaster Corps in determining the design and allowances of clothing and personnel equipment. (3) To collaborate with the Chemical Warfare Service in the study and investigation of chemical health hazards associated with operations of that service; and with other branches of the service where use of toxic solvents and heavy metals contribute health hazards. (4) To assist in the development of a comprehensive program for the control and limitation of accidents incident to military operations. (5) To determine by survey and study the individual health hazards of the several arms and services, and to formulate recommendations for preventive measures. Particular attention is to be paid to operation of mechanized and technical equipment. (6) To develop and institute a program of health education directed toward the general health needs of the command, with particular attention to currently important problems.

Housing.--Almost every conceivable kind of Facility was used for housing and sheltering American troops stationed in the European theater. Necessity was often the deciding factor. From the standpoint of comfort, shelter varied from the one extreme of the soldier in a fox-hole at the front to the other of a famous continental hotel housing troops of a principal headquarters (Figure 1).

The ability of the American soldier to improvise as need demanded met full challenge in many of the housing situations he was called upon to face. Irrespective of the kind of shelter that fell to his lot he developed unexpected potentialities of comfort, given a few days time (Figure 2). The absence of building material did not deter him from making good use of crates and packing cases and other seemingly useless building material. Even the pup tent was reinforced and added to, to the extent that at times it was difficult to recognize the original equipment.

The speed with which forces were built up in the United Kingdom during the summer and early autumn months of 1942 made necessary the waiving of customary standards of accommodation. Troops were housed in hutments, billets, barracks and tents. Progress in the construction program and the embarkation of large numbers of troops for North Africa served to reduce the need for tented accommodations. As the weather became colder and by late October tents were no longer used for the housing of troops.

Hutments were of various types, ranging from the double walled Nissen hut to those fabricated from tarred paper. Vertical walled huts were much used, and were constructed of bricks, concrete blocks, asbestos, wood and tarred paper. In general the huts made satisfactory quarters although overcrowding usually prevailed. Ventilation became worse especially in Nissen huts as longer and colder nights developed.



Figure 1

Soldiers on leave are quartered in resort hotels at the U. S. Recreational Center, Riviera, France, April 1945.



Figure 2

A Maginot line pillbox serves as quarters, 6th Armored Division, Kappel, Germany, December 1944.

The barracks loaned to the American forces by the British also varied greatly in type and construction. Those of modern design consisted of wooden spider barracks with quarters, washing and latrine facilities, and drying rooms all under one roof. Older barracks which served the peace time British Army were also employed.

Billets were provided by almost any building having walls and a roof, and included castles, manor houses, theaters, stores, armories, schools, and churches. Some had been severely damaged by bombing and in general remodeling and repairing were to some extent necessary before they served satisfactorily. Shortage of building materials and the need for shelter often required that these buildings be used before repair work could be done. Nevertheless, most troops of the theater were adequately housed in permanent or semi-permanent installations during the first six to eight months of 1943, except for some engineer general service regiments and engineer aviation battalions which were quartered in tents, usually winterized. The great influx of troops during the latter part of 1943 necessitated the extensive use of tented camps during the winter of 1943-1944.

Scales of Accommodation.--Obviously scales of accommodation prevailing in the Zone of Interior could not be applied in theaters of operation. In Great Britain there were just too many people in too small a country to give desirable accommodations for all. The British civilian population had its own housing problem because of the progressive losses by bombing. The British Army had to be housed, and with the American Army added to all this, it was completely necessary to scale down our standards of accommodation to a level approximating that under which the rest of the country lived.

Some apprehension was originally felt as to the effect this would have on the health of American troops recently arrived in a country whose climate offered little comfort. The housing conditions, together with the shortage of fuel, suggested factors predisposing to high rates for upper respiratory disease. It was a matter of satisfaction that even under austere living conditions no undue effect on health was noted and the rates for respiratory disease, as has been demonstrated, were always favorable. Even during the influenza epidemic of 1943 the housing situation precipitated no appreciable problem.

Scales of accommodation were established by the theater through joint action by the Corps of Engineers and the Division of Preventive Medicine, to serve as a guide to new construction and for the alteration and remodeling of existing structures. Table 1 gives construction scales for both the United Kingdom and Continental operations. It is not to be assumed that the facilities stated were always provided. Shortage of time, materials and labor

often made that impossible, even for so-called fixed installations and particularly for those which involved the remodeling of old buildings.

The original minimal basic allowance for hutted accommodations was 40 square feet of floor space per man. As the number of troops increased it was necessary to establish austerity scales which reduced the area to 35 square feet per man. Double bunking was subsequently adopted for all types of housing except Nissen huts and covered asbestos huts, and a scale of 400 cubic feet per double bunk was used in place of the regular allowance.

Tented scales were of two types, those prescribed for summer and those for winter use. Eight men were quartered in a 16x16 standard pyramidal tent under the summer arrangement, which allowed 32 square feet per man. Seven men were housed in winterized tents which gave an allowance of 35 square feet to each man. Winter tented scales were in effect during the period 15 October to 15 March and tents were used only in the absence of hutted accommodations.

In the United Kingdom tents were winterized by constructing sidewalls of wood, celotex or similar material and providing floors. A standard United States Type M-41 tent stove provided heat. On the continent winterizing was not done, on the understanding that occupying troops would provide floors from locally available material. The M-41 stove or a suitable substitute was furnished.

WAC Accommodations.--It was generally conceded that women required more space and sanitary facilities than men. Separate scales for the Womens Army Corps were therefore established according to which a minimum of 48 square feet of floor space was allotted each person and double bunking was not practiced. With respect to sanitary facilities, a four percent allowance of showers and three tubs per 100 personnel was allotted as compared with three percent of showers only for men. The provision of washbasins in the WAC scale of accommodations was fourteen per hundred personnel as compared with eight percent for men; and 12.5 percent toilets as compared with 5 percent.

Billeting.--Developing limitations and commitments in transport, supplies and labor necessitated modification in the plans and construction standards made for housing and billeting troops. Troops were accorded facilities under billeting arrangements comparable to those of the austerity scale noted in Table 1. Theater policy provided for the billeting of Services of Supply and Ground Force troops, (excepting colored troops) whose combat efficiency would not be impaired by that arrangement. Where necessity demanded the use of billets without adequate bathing facilities, arrangements were made for the use of public baths.

Heating of Quarters and Other U. S. Army Installations.--

Difficulty in providing adequate heating of quarters and other installations came from two sources, shortage of fuel and unsatisfactory stoves. The fuel situation was of first importance. Fuel was rationed both in the United Kingdom and on the continent and the allowances necessarily established were never liberal. In Great Britain temperatures were specified of such degree that no room was to be heated above 65° F. and no warehouse above 55° F. Maximum allowances of coal or coke were prescribed to accomplish these ends. From the first of May to the 22nd of October the allowance was three pounds of coal or coke per man per day. During the period 23 October to 1 May the allowance was eight pounds. Kindling wood was allowed in the proportion of one pound per 40 pounds of coal or coke.

These allowances of fuel had to meet all purposes, including heating of quarters, provision of hot water, and cooking; except that no restriction was placed on hospitals. Provision was made that the fuel allowance for any organization could be increased by one-half upon written authority of the commanding officer, supported by medical opinion as to need. While these allowances were small they proved sufficient from a health standpoint if not always in respect to comfort.

The second principal difficulty in the United Kingdom in providing adequate heating came from the use of British type stoves. Ordinarily they were lined with fire clay and were without grates, which made it difficult to maintain a fire and to obtain the maximum heat from the allotted fuel. A study of the efficiency of various sizes and types was made in the summer of 1943 in collaboration with the Corps of Engineers, the results of which lead to the authorization of larger stoves in many types of installation.

The United States Army tent stove, model M-41, was a better stove than any encountered in any country, but unfortunately supplies were limited and the equipment was never available in sufficient quantities at any time.

Fuel was scarcer on the continent than it had been in Britain and rationing was necessary even for hospitals. During the season when heating of buildings was necessary, four pounds of coal or coke was authorized per man per day for all purposes, and 12 pounds per day for each hospital bed. The scale of prescribed temperatures for various types of installations provided a temperature of 62° for living quarters and mess halls, and a level of 65° for recreational buildings and offices. The permitted temperature for infirmaries was 70° and drying rooms for clothing were maintained at a temperature of 75° F. The prescribed temperatures were rarely maintained, and whether he was a general or a private the soldier's remembrance of the winter of 1944-45 was of a mighty uncomfortable and foreboding situation.

Ventilation.--The maintenance of proper ventilation in living quarters met two important difficulties. In the first place the blackout interfered materially with normal arrangements and secondly, the limited provision of heat gave rise to a tendency on the part of troops to keep warm irrespective of proper ventilation.

To obviate the first difficulty improved types of blackout devices were developed for windows and doors. In the early days, flat panels were used which rarely fitted properly when the window was closed. Louvre space was insufficient and the provisions for ventilation were negligible. Curtains were far superior in that if a breeze was even slight it would pass down and around the fabric and the air that was in the building had some opportunity to remain fresh. Shortages of cloth and other materials prevented the general adoption of this method.

Despite the vigilance of commanding officers troops continually blocked the ventilator openings of huts in order to keep warm. The limited fuel allowance, the restriction of fires to a few hours in the evening, and the type of building construction all contributed to excessive heat loss. There was often good reason to consider warmth more desirable than fresh air.

Because of the recognized deficiencies in proper ventilation of hutted installations a study was made in cooperation with British authorities whereby various types of ventilators were tried in huts actually occupied by troops. Demonstration Nissen huts with an allowance of 32 square feet of space per man were erected in Hyde Park, London, by the Ministry of Works and Planning in cooperation with the Royal Army Medical Corps. Blackout baffles installed on the outside of buildings were found to be a decided improvement. This measure together with the recommendation of the Division of Preventive Medicine for a standard one and one-half square foot inlet and outlet opening per ten men, led to improved ventilation of huts.

Ventilation in Nissen cook houses was inadequate during the early months of the theater, and was a matter of importance because field ranges were often used in place of stoves. The toxic effects from incomplete combustion of gasoline were well known. Hooded ventilators were installed to remove gases and odors from kitchens.

Ventilation of quarters and other accommodations on the continent can be dismissed with the statement that there was always too much of it. Housing accommodation was usually makeshift, a great proportion of troops were under canvas, and permanent camps were a rarity.

Bathing and Ablution Facilities.--Bathing is one of the outstanding personal habits which suffers in any military operation. Even when facilities are available such factors as climate and military

assignments and not infrequently military necessity tend to interfere, and to deter troops from bathing. Sanitary orders of field commands usually stated that all men would bathe at least once weekly but bathing by roster was sometimes necessary to overcome the reluctance on the part of many because of the difficulties and the crudeness of facilities provided.

Scales of accommodation for fixed installations in Great Britain provided for three shower heads per hundred men. Ablution facilities allowed one nine-foot bench with four cold and four hot water taps per 100 men or if material were available eight wash basins per 100 men. These scales were less than those provided in cantonments of the United States, but were sufficient to permit satisfactory cleanliness with reasonable comfort.

The original construction standards provided by British engineers for camp buildings to be used by American troops directed the omission of bath houses where the water supply was limited, with the intent that water would be heated on Soyer stoves and used in tubs. The more extensive construction involved in providing bath houses was not believed justifiable for the time these accommodations would be used. Knowing that the American would neither accept nor adopt this method of taking a bath, the specifications were altered to state that tubs would be located only where an adequate water supply was available, which was a good international compromise.

Stoves for heating bath houses were not provided in early specifications for construction of camps. It was soon apparent that the danger from exposure when taking a bath in winter outweighed the hazards arising from no more than minor meticulousness in personal cleanliness. Bathing was abstained from so commonly that surveys by sanitary engineers served to demonstrate that heating of bath houses was a requisite to good health, and authorization of stoves followed. Similar action was taken in respect to ablution facilities in tented camps which afforded only partial shelter.

Bathing Facilities on the Continent.--Bathing facilities on the continent were principally of the field type. Such provisions as existed in requisitioned buildings were used as they were, and in their absence improvisation by unit handymen was commonly practiced. If adequate facilities could not be brought about, army field equipment was operated by the Quartermaster Bath and Sterilization Companies.

The ordinary provision of field bath equipment to troops of the line, quoting from the experience of the 9th Army, was one Bath and Sterilization Company to each corps. A company could serve an average of 5,000 men a week. The experience of many field organizations indicated this provision to be insufficient, and it was a general opinion that a mobile or portable unit should by choice

be assigned to divisions or regiments. Shower facilities controlled by corps proved unsatisfactory, since frequently men were relieved and sent to rest areas where showers were not available during the time they were there.

Troops again improvised all sorts of shower units as they did with most things (Figure 3). Some were of sufficient merit to deserve consideration in future planning for field installations. Among troops of the theater those of the Air Forces, Ordnance, and Engineer units usually fared best in bathing facilities since they had the advantage of trained mechanics and tools, and somehow found the materials with which to extemporise their own bathing facilities where regular provision did not exist.

Clothing and Equipment.--The specifications for the uniform provided United States soldiers in the European Theater originated with the War Department. The standard winter uniform was worn both winter and summer and for the climate of the region in which troops were stationed, that arrangement proved satisfactory. The uniforms supplied in the early years of the theater failed to meet the requirements of the combat soldier and led to thorough review of the problem. A new winter uniform was developed in 1944 and first supplied to troops of the theater in late autumn of that year. It came into general use the following spring (Figure 4). The shortcomings of previous equipment and the attendant difficulties have been discussed in detail in connection with cold injuries and trench foot.

The Medical Department worked closely with the Quartermaster Corps in the minor and sometimes major requests for augmentation of clothing for special troops, or groups subjected to unusual degrees of exposure to cold and wet. Such instances were numerous and decision was based on individual circumstances. The basic allowances in general proved adequate and indeed liberal.

The Division of Preventive Medicine directed special attention to the provision of drying rooms for clothing as perhaps the most important feature of clothing as a health consideration. The original building specifications for camps in the United Kingdom contained no provision for this important part of life in the field. It was generally given too little consideration by commanding officers of combat units.

Much effort was expended in educational measures directed toward demonstrating the value and usefulness of drying rooms in furthering the comfort of soldiers, as well as in the prevention of respiratory infections. Most permanent camps and installations were eventually provided, on the basis of one square foot of drying room space per man. In combat units where fixed installations for this purpose did not exist, tents were turned to the purpose and served adequately when properly heated.



Figure 3

An improvised front line shower, 106th Infantry Division, February 1945.



Figure 4

New winter clothing is issued to the 8th Infantry Division, Hurtgen Forest, Germany, January 1945.

Identification Tags.--The identification tag worn by all officers and enlisted men was a simple piece of equipment and yet several problems were associated with its use. It became evident early in the course of operations that the bodies of men involved in fatal accidents or casualties associated with fire, often failed of identification because the identification tag became separated from the body. The cloth tapes by which they were attached burned away, and caused confusion in group accidents, a circumstance first noted in airplane crashes in the Eight Air Force. Similar experiences could be anticipated among men of the Tank Corps, in the Chemical Warfare Service and in other arms and branches of the service. A representation was made to the War Department suggesting that metal chains be substituted for the cloth tapes, a matter which was accomplished through publication of a new Army Regulation.

The metal identification tag was not sufficiently large to accommodate the stamped record of the repeated stimulating doses of tetanus toxoid. A request to the War Department for clarification led to a ruling that only the first reinjection was to be recorded on the tag. Those administered subsequently were to be noted on the immunization record.

The recorded blood group on the identification tag was the most important piece of information to the soldier himself that the tag carried. A survey of the reliability of the information demonstrated an error of about six percent in the recorded blood group. More than seven percent of soldiers were wearing no identification tags at the time of survey and in some few instances no blood group had been recorded. Action was initiated to remedy those deficiencies.

Chemical Health Hazards.--A common conception exists that occupational or industrial hygiene is a matter wholly limited to poisoning by heavy metals or by organic solvents concerned with the daily work of an individual. The broader interpretation of the field that has already been stated would relegate these interests to a minor consideration, compared to the aspects of industrial or military life which bear directly on the everyday personal problems of the individual. Nevertheless, chemical poisonings do exist in military as well as civilian occupations, and the necessary attention was one of the interests of military occupational hygiene.

Tetra-ethyl Lead Gasoline.--The hazards connected with handling loaded gasoline warranted serious attention since the concentration of tetra-ethyl lead in this fuel was increased above levels formerly employed. The best available information was that a single application of this substance to the skin as a method of gas decontamination initiated no hazard of poisoning by lead.

Inhalation of the vapors and the products of combustion were known to be detrimental to health. The rate of absorption by

inhalation under ordinary exposure was about three times more rapid than the rate of excretion so that the poison was cumulative. Only leaded gasoline was supplied to troops of the European Theater and this was the gasoline used in field ranges. Leaded gasoline had an octave rating of 60 as received and this was increased by adding lead tetra-ethyl to bring the rating to 80. An asbestos filter for the range was designed to catch the deposit of lead oxide formed by the decomposition of the tetra-ethyl. Actually it retained only about 40 percent of the products of decomposition and the remainder choked the feed line between the filter and the burner. This required replacement of the filter disk after four hours use of leaded gasoline. Contamination of the atmosphere or of food by lead would occur through distribution of lead oxide dust formed from tetra-ethyl not decomposed before reaching the filter disk or by tetra-ethyl which escaped during the five to ten minute period at the start of operations before a proper combustion temperature was attained. The flame of the range was luminous and oxidation was incomplete. The possibility of lead poisoning among cooks was remote in the case of ranges used in the open or in well ventilated rooms, but a hazard did exist in small poorly ventilated rooms.

Poisoning with organic lead compounds had few of the essential clinical features of classical lead poisoning by inorganic lead salts. The clinical reaction was essentially that of a generalized intoxication combined with the manifestations of an encephalopathy. The onset may be insidious or abrupt, depending upon the nature of the exposure. If the onset is insidious, the first symptoms are lassitude, easy fatigability, headache, and insomnia with sometimes more generalized constitutional symptoms. If the process progresses or if the onset is abrupt, the symptoms are predominantly mental, and those of a toxic psychosis, the pattern of which is determined by the previous personality of the patient. Intractable insomnia is perhaps the most characteristic single symptom. There are few or no neurologic signs and none of the manifestations characteristic of poisoning with inorganic lead. The diagnosis should be suspected when a patient has been exposed to tetra-ethyl lead, is afebrile and presents minor or major symptoms of a disturbance of the central nervous system.

The recommended preventive measures required provision of adequate ventilation when the field range was used indoors, the avoidance of excessive spillage of gasoline and if it occurred that it be removed by washing away with water or covering with earth. Care was taken to protect food from the fumes during the process of cooking. Food was not to be toasted or grilled directly over the fire of the field range. Field ranges were cleaned and filters replaced in accordance with the operating instructions issued for their use. Repeated contact of the gasoline with the skin was avoided and where such occurred the affected part was washed promptly with soap and water.

Poisoning from Food Containers.--Metal cans used as improvised food containers were found to be associated with danger of lead poisoning. The boiling of water and the cooking of food interne or tin plated gasoline cans was specifically prohibited although storage of water was permitted. Lead and other metals were commonly used as substitutes for tin. The possibility of zinc poisoning following long contact of acid foodstuffs in zinc lined containers was well-known. Action was initiated to limit accidental food poisoning due to these two heavy metals.

Tetra-chlorethane.--Tetra-chlorethane presented an occupational hazard in the impregnation of clothing against gas. Some dozen or so cases of poisoning had occurred at Edgewood Arsenal, with one death. Careful control of all employees engaged in this work was instituted. The effects of the chemical are principally on the lungs through inhalation, although absorption through the skin can take place.

An adequate control of the process itself had been demonstrated as the best preventive measure, an important feature being the use of rakes to handle the wet clothing. The program for protection against this hazard in the European Theater impregnating plants included a careful selection of personnel to avoid those with indications of existing liver disturbances, adequate control of the process and finally periodic examinations of employees by icteric index, physical examination, and other indicated medical measures, in order that persons showing slight toxic effects might be early withdrawn from association with the chemical.

Methyl Bromide.--The necessary measures for elimination of toxic effect from methyl bromide in disinfection processes have been considered in the discussion of that method in the control of lice.

Poison Liquor.--Only an occasional toxic effect from drinking liquor containing methyl alcohol or other harmful agent was ever noted during the stay of American troops in the United Kingdom. Such circumstances were no more common than in continental United States. For one thing, beer was everywhere available in the public houses of Britain and while it was war time beer, still the "mild and bitter" of Old England came to be almost as much favored by the American soldier as it was by the common man of the country. Poisoning rarely results from beer.

Hard liquor of the class of brandies and whiskeys was decidedly scarce in Britain. Purchase by the bottle was almost impossible and while drinks by the glass could be obtained in recognized bars this was scarcely a source of danger of poisoning by methyl alcohol. It is the nondescript liquor of the bootlegger and the cheap bar or brothel that leads to accidents.

Conditions were otherwise on the continent. Beer by contrast was in relatively limited supply and not so easily obtainable, because troops were in the field and towns were off limits. France was a great wine producing country and the use of light wines was a part of every day life. The temptation to reinforce them led to purchase or acquisition of alcohol of uncertain pedigree, and the alcohol most readily available was wood alcohol.

While the difference between wood alcohol and grain alcohol was known to most soldiers, and the toxic effect of the former was generally appreciated, a certain carelessness or indifference was usual. The attitude of the combat soldier came strongly into consideration as a factor contributing to the frequency of poisoning by methyl alcohol. Life loses much of the established sense of values conditioned by a modern civilization, with the result that a soldier out of the line and with the first pass or furlough in weeks was in the mood to drink just about anything.

As in most wine producing countries, distillates of wine were commonly produced and used in France. Lacking the potency of whiskey, which means hard liquor to most Americans, alcohol was often added. Local dealers and even farmers and small producers of wine were not averse to manufacturing artificial cognac and similar products through addition of flavoring and coloring materials to alcohol; and wood alcohol or mixtures of wood and grain alcohol commonly formed the basis for such drinks.

Poisoning by methyl alcohol came to observation soon after troops landed in France, but records of those early weeks were indefinite and incomplete as they were for most health matters. The cases were associated with the favorite local drink of the Normandy peninsula, known as Calvados. The Surgeon of the Ninth Air Force gave the first authenticated report of death from poison liquor on 3 October 1944, with information of six deaths among men of that command. Four were from drinking Calvados while the unit was stationed in Normandy and the other two in September were related to cognac.

Beginning 1 October 1944 records were maintained at theater headquarters of all incidents associated with this problem, and on the number of deaths that occurred.

Types of Poison Liquor.---Poisoning many times came from just plain bad liquor, the nature of which remained undetermined with a history almost invariably suggesting a shady or suspicious origin (Figure 5). For example, an enlisted man of the 4199th Quartermaster Service Company died on 27 May 1945 and three others of the unit were seriously ill from drinking liquor obtained from a German civilian at Rheinberg.



Figure 5

Yanks capture a rathskeller in Borgel, Germany,
January 1945.

When samples of the liquor concerned with such events was obtained for laboratory examination, the reason for the difficulty was usually apparent. Of thirteen samples of various alcoholic beverages examined in February 1945 by the central laboratory of the theater in Paris, seven contained methyl alcohol ranging from one to thirty percent by volume. The presence of aromatic extracts often made it impossible to detect by odor the presence of methyl alcohol. Of ten samples of blood of patients admitted to one General Hospital, three were found to contain methyl alcohol as well as ethyl alcohol.

Death in some instances resulted from drinking straight methyl alcohol. An instance came from the 404th Fighter Group (SE) of the 9th Air Force. A private of the Air Force was found dead in bed at 0600 hours 24 October 1944. He had been drinking during the previous day and his associated stated that he obtained the beverage from a captured 50-gallon German barrel labeled "Methanal Giftig GEF 26-5-44". A half filled quart bottle of the liquid was found beside his bed.

While methyl alcohol was most commonly involved at least one instance is known where the trouble originated from diethylene glycol. Again, soldiers of a Quartermaster Truck company sold some antifreeze to a local cafe keeper in Belgium. Not only did such dangerous products come back to soldiers of the United States Army in the drinks they bought but a number of deaths of civilians occurred from the same cause. As bizarre as was the origin of poisoning from anti-freeze mixtures, it was perhaps exceeded by methyl alcohol poisoning from canned heat, a solid substance containing methyl alcohol and used for heating rations and other purposes. Several men from one of the field armies drank beer into which they had squeezed methyl alcohol from a cake of canned heat. One was admitted to the 59th Evacuation Hospital, several others were ill, and one had died that night. Methyl alcohol was determined as the cause of death.

Buzz bomb fluid was another unusual substance, the ingestion of which led to poisoning. This substance was used by the Germans in launching their rocket bombs and large supplies were found in many parts of Germany. Three men from Battery B, 413th AAA Battalion and one from the 1119th Military Police Company, Avn., gave a history of drinking buzz bomb fluid from a tank car at Eschwege. They were admitted to the 56th Evacuation Hospital, where the staff was wholly familiar with the condition for they had already had four deaths from the same cause.

While the appearance and taste of liquor often raised no suspicion of its content of methyl alcohol, it was almost past understanding how any one could be lured into drinking the concoction that led to the death of three soldiers and the evacuation of a

fourth to the Communications Zone with a diagnosis of "poisoning, acute severe, caused by drinking questionable beverage." Two jugs had been found in a building where the soldiers were billeted, one labeled "methanol" and the other "formaldehyde". The contents were mixed and bottles filled from the jug. The liquid was diluted with water before drinking. Laboratory analysis showed the presence of both methyl alcohol and formaldehyde.

Incidence of Poisoning from Liquor.--The number of cases of acute poisoning that occurred before October 1944 from drinking bad liquor is now known; but informal reports that came to the Office of the Chief Surgeon and through contact with medical officers of the theater, the estimate is at least a dozen. Records were available from October 1944 to the close of hostilities in June 1945. The number was not great during the autumn of 1944. An increase became apparent after the first of January. As the war drew to an end, reports became more and more frequent with no less than 82 deaths from this cause in May 1945. The total for the period of operations on the continent was 178, to give a mortality rate of 0.12 per 1000 strength per annum.

The majority of cases and deaths from poisoning by methyl alcohol or other toxic agents in liquor, were among troops of the Ground Forces. The Air Forces were involved to a certain extent, but the troops of the Communications Zone relatively little; not that their judgment was probably any better, but their source of supply was. The seriousness of the problem among interests in Preventive Medicine becomes apparent when comparison is made between the number of deaths from poison liquor and those that resulted from acute communicable disease. The number of deaths from the latter cause was 162; and deaths are included from primary pneumonia, tuberculosis, encephalitis of all forms, and meningitis both primary and secondary, as well as from the more commonly recognized communicable diseases. Even with this liberal interpretation the number of deaths and the mortality rates for alcohol poisoning were greater, 0.12 per thousand per annum compared with 0.11. (Table 2)

Incidence Among Displaced Persons.--The hazards of poison liquor were by no means limited to the American Army. Civilians participated and more particularly the group of displaced persons. A medical officer of the 2829th Engineer Combat Battalion was called to investigate the difficulties into which a group of Russian displaced persons had fallen. Men from a large camp at Landenprozetten obtained some liquor from Germans of the neighborhood on 11 April 1945 and forthwith indulged in a drinking bout. Several hours later the nearby German community called on the United States Army for help, insisting that the refugees were fighting. When a medical officer arrived in the Russian area, some ten men were found in severe convulsions, rolling on the floor, jerking at their throats,

calling out that their stomachs were on fire and having difficulty in breathing. The remainder of the men were under the care of their women folk who forced them to vomit and kept them walking. Four were dead the following morning. Samples of the liquor were not available for laboratory examination because the Russian women had destroyed it. Only the men of the camp had drunk the liquor, the women refusing because "there was fuel oil in it."

The most outstanding of all incidents connected with poisoning from liquor occurred at the Handelar refugee displaced person camp. In all, there were 80 cases of poisoning. Sixteen displaced persons had died by the time an investigation was first instituted, and subsequently 42 others died in hospitals. Of the 80 patients only 22 survived of whom three were left totally blind, and three lost the sight of one eye. The 58 deaths represented a fatality of 72.5% among those known to have partaken of the liquor. Because of language difficulties the origin of the liquor was never determined precisely. The best that could be brought out was that it came from a factory building where it had been discovered by one of the displaced persons, and was poured by the leader from some form of large container into bottles as the men formed in line.

The patients were admitted to hospitals in various stages of poisoning. The least affected group had no particular symptoms except for a tendency to lie quietly as if exhausted although still alert and oriented. Subjective symptoms were difficult to obtain because of language difficulty and because the patients were too ill to talk. The general complaint was of severe frontal headache, substernal burning pain, and pain in the epigastrium. A tendency to vomit was usual.

The chief symptoms of a second group were severe abdominal pain and vomiting, so severe indeed that they writhed about and moaned continuously. They were semicomatose, had fixed pupils and a fixed stare; rising out of their stupor only when the pain stopped or when they vomited a mahogany colored fluid, stringy with mucus and containing bile.

In addition to abdominal pain and occasional vomiting, a third group of patients exhibited delirium bordering on mania, of such extent that mechanical restraint was often necessary. Generalized tremors and tonic and clonic convulsions were frequent.

A fourth group were in profound coma or moribund. The skin was cold but not moist. They were cyanotic, and depending on the nearness of death, respirations were rapid, shallow, or slow irregular and convulsive. A remarkable feature was that the pulse often slowed to 30 or 40 beats per minute along with the slowing of respirations, a symptom that was always terminal. Shortly before death the victim frequently manifested a generalized tonic or clonic convulsion. Death

was due to respiratory paralysis followed by rapid heart failure. Beginning respiratory difficulty was evidenced by an increased respiratory rate, cyanosis, rapid feeble pulse and falling blood pressure. Some of the first group proceeded through the several stages to ultimate death, so that the separations made apparently represent different stages in the process of poisoning rather than different levels of involvement. Those who recovered never exhibited the more serious symptoms of the last two groups.

Program of Prevention.--Because of the nature of the problem, relatively little could be accomplished by formal directives from theater or other headquarters. Principal reliance was placed on popular education through the Army newspaper, Stars and Stripes, and on similar sources of disseminating information to the soldier himself.

A more tangible contribution was made in providing the troops with a readily available, safe and innocuous beverage in the form of beer or soft drinks, through the program initiated in the autumn of 1944 with the Special Services Division and described in connection with sanitation.

Prevention and Control of Accidents.--The statistical demonstration of the importance of non-battle injuries as causes of death and disability among troops of the European Theater is presented in the concluding section of this presentation, but no more than cursory familiarity with the problem is needed to appreciate that accidents and injuries rank well up among preventable disease conditions.

The Medical Department had the obligation in safety programs of the theater to maintain statistical data with reference to the number, frequency, severity, and causes of injury to military personnel and to provide the Provost Marshall with adequate summaries of disabling injuries. Additionally the Provost Marshall was aided in the determination of doctrine and in the preparation of educational aids for safety training.

Staff supervision of safety programs designed to limit the number of preventable accidents was a responsibility of the Provost Marshall of the Theater. Fundamentally, the responsibility for the operation of a safety program for military and civilian personnel and prisoners of war rested with the commanding officers of unit installations (Figure 6).

Annual Surveys of Causes of Non Battle Injury.

In furtherance of its obligation, the Division of Preventive Medicine prepared extensive analyses of non-battle injuries for the years 1942, 1943, and for the first half of 1944, the period immediately preceding continental operations. The press of military activities and the major problems of trench foot and later of typhus fever so absorbed staff and facilities that detailed analyses for the continental period were



Figure 6

An accident due to a skid on an icy bridge in Luxembourg,
January 1945.

not made, although general features of accidents and injuries were abstracted, and detailed studies made of specific problems.

It is not to be assumed that all non-battle injuries are preventable. Some classes definitely are amenable to improvement through safety campaigns, others are not and there is a broad intermediate zone difficult to evaluate from the standpoint of preventability.

Any separation of preventable and non-preventable injuries must be wholly arbitrary. To accomplish the purpose at hand, the important causes of non-battle injury deemed preventable have been incorporated in Table 3. The frequency of preventable accidents is noted for two groups of Army personnel, those whose injuries were of sufficiently minor moment to permit ultimate return to duty, and those having injuries of such extent that return to the Zone of the Interior was necessary.

The extent to which the listed preventable accidents entered into deaths from non-battle injury formed the second part of the analysis.

Somewhat more than 20 percent of non-battle injuries among patients who eventually returned to duty were due to what have been considered preventable causes. It would appear that the more serious injuries, judged by the necessity to invalid the patients home, were due to preventable causes, in still greater proportion; namely, 45 percent. The preventable conditions were easily the most highly represented among deaths from non-battle injury, to the extent of about 73%. Stated differently, it would appear that a great many injuries occurred in military practice which were not readily preventable, but that of those which resulted in death and more serious injury, a great proportion were preventable.

The year 1943 may be taken in illustration of general experience with non-battle injuries during the period of training activities in Great Britain. During that time only the 8th Air Force was actually engaged in combat.

In the course of the year, 24,919 officers and men of the European Theater were admitted to hospital for non-battle injuries. Of these, 95.7% were returned to duty, 1.1% were evacuated to the Zone of the Interior, and 3.2% died.

The ten most frequent causes of injury are listed in Table 4. Accidental injury by falls was easily the most common cause of disability, but was not far removed from those accidents which occurred in the course of athletics, sports, and recreation which accounted for 10.6% of all non-battle injuries. The proportion due to motor vehicle accidents was 7.9%.

A relatively small proportion of patients suffering accidental injuries developed disability of such extent that their return to the Zone of the Interior was necessary. The number was 275 or 1.1% of all non-battle injuries. Approximately one-fifth were the result of motor vehicle accidents, by which it may be judged that this was a common cause of serious accidents. About one-sixth resulted from accidental injury by falls. The chief reasons for evacuation are set forth in Table 5.

Most serious accidents, judged by a result in death or evacuation to the Zone of the Interior, were due to air transport accidents. Of the 809 fatal accidents during 1943, 54.5% were air transport accidents, 13% due to motor vehicles, and 8.5% resulted from mishaps with fire arms. The major causes of accidental deaths listed in order of frequency are to be found in Table 6.

A sample of individual sick and wounded reports for the period January through March 1944, exclusive of deaths and those evacuated to the Zone of the Interior, were examined to determine which arms and branches of the service participated most frequently in this type of injury. The data are set forth in Table 7. The sample consisted of 1693 cases of what may be termed the minor accidental injuries of the theater and corresponding to about 20% of reported instances. The greatest numbers were noted for the infantry, but if the comparison is made on the basis of troop strength, the frequency of these conditions among the Air Force was generally high. The relatively great numbers for the Ordnance Department and the Corps of Engineers are to be noted.

An analysis of deaths from these causes during the same period of time showed a disproportion between cases and deaths in respect to the infantry, in that fatal accidents were relatively few. By far the greater number of fatal accidents occurred in the Air Forces, and the proportion of deaths from accidents was also relatively great for the engineers. Table 8.

Unit Surveys.--Aid was frequently furnished to units of the theater in analyzing the particular causes of injury in the unit as the basis for a unit safety program. Sometimes this was at the request of units, more commonly as a means of contributing constructive help rather than the usual criticism which comes from higher headquarters to units with unfavorable rates. These special studies were most often related to engineer organizations and to infantry divisions.

Motor Accidents.--In 1943 a special study was made of the situations concerned in automobile accidents, for use by the Services of Supply in a program designed to limit disabilities from that cause. Such problems are as readily amenable to epidemiologic analysis as are those related to communicable disease.

Motor accidents were separated into those resulting only in mechanical mishap, those causing personal injury as well, and finally those which resulted in death. Time and space relations were determined for accidents attended by personal injury, with briefer attention to such factors as fatigue, types of injury, causes of death and the kinds of vehicle involved.

Under civilian conditions most automobile accidents occur during the evening rush hour of five to six o'clock. In this military experience the greatest proportion was associated with night driving, the hour from 2300 to 2400 hours showing the highest accident rate.

Personal and Individual Health Problems.--It is easy to develop enthusiasm about such tangible health problems of the individual soldier as those just discussed - poisoning by methyl alcohol, the trench foot problem and housing difficulties. The minor considerations add up to a total that is usually unappreciated, but important in determining the level of fitness of the individual, his sense of well-being and his quality as a soldier. This is the field which has been referred to as perhaps the most undeveloped in the practice of military preventive medicine.

Personal hygiene as here considered is interpreted in the broad sense of including all matters having to do with the physical and mental and psychologic well being of the individual and is far removed from the too general interpretation of the field as one having to do with such things as brushing the teeth and washing the hands. The interests of the neuropsychiatric service and those of Preventive Medicine have opportunities for enlarged and cooperative activities. The whole program of public health education could well be incorporated into this activity, instead of being left indiscriminately to various branches of preventive medicine as so commonly is done. The field warrants the full attention of at least one officer in any organized division of Preventive Medicine.

No attempt will be made to list or discuss the various sources of interest which entered into this activity in the European Theater, but a few examples will serve to indicate types.

The development by the Air Forces of a special division of work in Preventive Medicine called the Care of the Flyer was easily the best thing done in the theater in this particular activity. The functioning of the human mechanism, physically, mentally and psychologically was recognized as of equal importance to the mechanical performance of the aircraft he operated.

The Army was setting out for France and an Army on the march would have foot troubles of a degree unassociated with normal

camp life. Much time was devoted to informing the soldier of the kinds of difficulty that feet encounter and what could be done about them.

The common roller towel was a frequent inheritance of American units when they took over British quarters and it was surprising how frequently this relic of other days came to be observed in American installations. It was rooted out with difficulty, because of inability to supply the usual paper towels and the lack of another substitute.

Public opinion was sometimes ahead of practical method, as in the request of a headquarters for recommendations on methods to sterilize mouth pieces of telephones. It was necessary to point out that available measures were useless, and to emphasize the lack of result from token efforts.

The supply of socks provided troops from American sources was necessarily augmented by purchase of British supplies, so that at one time no less than four different kinds were provided American troops. The sizes were different, as manufactured in the two countries. It was a small matter to point out which items could logically be substituted for size and for intended use; and yet lack of that simple information gave rise to much foot trouble.

These are small affairs but they remain neglected without the attention of some specifically designated officer of the Preventive Medicine Service. The personal contribution to individual health and welfare which remedy often brings, serves to enhance the appreciation of the aims of the preventive program and to enlarge its support. It is good public health education.

Trench Foot.--The outstanding event in preventive medicine in the European Theater, considering the whole course of the war, was a widespread and extensive prevalence of trench foot which began in November 1944 and continued throughout that winter (Figure 7). Because separate and independent consideration is given this subject in a medical monograph trench foot will be presented here only briefly. The material which follows is quoted in its entirety from the annual reports of the Division of Preventive Medicine for the years 1944 and 1945.

Sources of Statistical Information.--In conformity with War Department directives trench foot, immersion foot and frostbite were made reportable diseases as of November 1944, using the Weekly Statistical Report Form 86ab. Form 323 gave earlier information because it was a daily report, but was less exact because of inherent duplications.

Trench foot in previous years had been recorded in medical statistics as "cold injury." The 86ab reports defined three forms



Figure 7

Cold Injury, 108th General Hospital, Paris, France,
December 1945.

of cold injury, trench foot and immersion foot which resulted from wet cold, and frostbite which arises from exposure to dry cold. Frostbite was further qualified as cold injury, ground type, and cold injury, high altitude type. Because of previous practice a certain number of cases in this experience were reported simply as cold injury and others as cold injury, ground type. These were all included in the analysis of data under the term trench foot. Only cases listed as frostbite were so recorded, irrespective of whether they were also qualified as high altitude or ground type.

The disease on the continent was almost wholly of the ground type and originated in the Ground Forces. Frostbite first appeared in the week ending 8 December 1944. Reported cases increased thereafter so that in one week the 3rd Army alone reported no less than 611 cases.

The general term of cold injury, to include all three of the above categories was believed best suited to epidemiologic study and for statistical purposes generally. Differential diagnosis was difficult and it about came down to determining whether a given injury occurred above or below freezing temperature. Pathologically the several conditions were much the same and varied only in degree. The same contributing factors held in causation and much the same principles were involved in medical management.

While separate records were maintained for frostbite, all three conditions were considered as a unit in the analyses to follow and were called cold injury.

Cold Injury in the ETO. Medical planning of the theater had long anticipated that cold injury would be a matter of major concern during operations on the continent. The problem entered actively into the plans for mounting continental operations. Methods for combating trench foot and for disseminating information on the subject were initiated in June and continued throughout the summer. Directives were issued in September, others in October and still others in November.

Trench foot did not appear in the theater in appreciable numbers until about 10 November, this being coincident with the start of active offensive operations and the development of colder weather (Figure 8). The incidence of cold injury increased sharply at that time, almost in the manner of an outbreak of influenza, and thereafter progressively declined so that in the early weeks of December the incidence was less than one-fourth what it was at the point of maximum occurrence about 15 November.

This second general phase was followed by another major peak about the middle of December. This again was related strongly

and definitely to military operations, the major counter-attack of the Germans (Figure 9). Trench foot in the First Army was at this time more common than during the November peak. There was an appreciable rise in incidence in the Third Army, while minor upward swings were noted in both the Seventh and Ninth Armies. The next two or three weeks again showed a well-marked improvement in the situation.

The fifth general phase of the curve became evident in the second week of January with a sharp upward swing of cold injuries as the weather became decidedly more severe, with freezing temperatures and much snow. A large part of the increase was due to the appearance of frostbite.

For the month of November the number of reported cases of cold injury was 9,328 and for December it was 13,024, a total of 23,352. The equivalent of two divisions of troops were lost from this cause. It was evident that more energetic control measures were necessary. These became active in January through institution of a control program based on that which had proved successful in combating malaria, a disease whose control likewise depends on personal and individual measures.

The final peak in January and early February occurred at a time when the troops were engaged in bitter fighting over rough snow-covered terrain. Milder weather occurred about the first of February, the snow melted rapidly and the incidence of cold injury dropped precipitately. Table 9, Figure 10. The majority of cases of cold injury occurring in January and early February were of the type of frostbite, while those occurring later in the spring were predominantly trench foot.

The number of cases reported by days for the four armies in the theater is also shown in Table 9. Rates per thousand strength per annum by weeks are set forth in Table 10.

Frostbite.--Frostbite was no problem until early December, but thereafter the number of cases progressively increased, Table 11.

Cold Injury by Services.--An analysis of cold injury as it affected the various major commands of the theater showed the condition to be far and away a problem of the Ground Forces. Almost no cases occurred in the month of November in the Ground Force Replacement Command, among Communications Zone and Air Force troops of the continent. December showed an appreciable number in the Ground Force Reinforcement Command, largely due to patients released from hospital who returned to that organization and developed recurrence. There were few primary attacks. The numbers for the Communication Zone and the 9th Air Force continued minimal. The admissions per thousand per year were greater in December than in November. The data



Figure 8

A Ninth Army tank bogged down by mud, November 1944.



Figure 9

Heavy machine gun fire pins down a combat patrol of the 2nd Infantry Division, Ondenval, Belgium, January 1945.

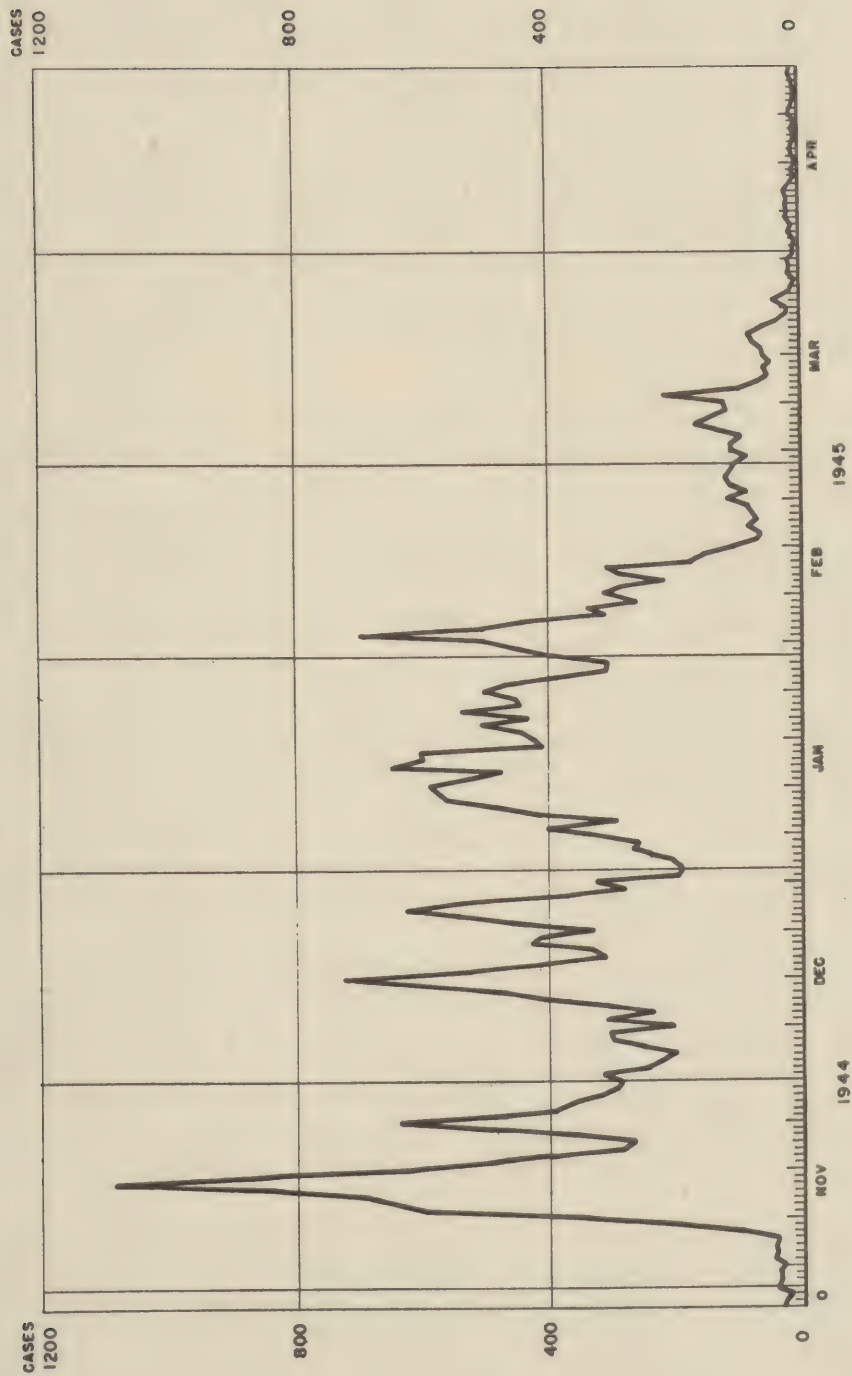


Figure 10

Cold injury, all armies, European Theater of Operations, daily admissions
1 November 1944 to 27 April 1945, inclusive.

are presented in Table 12.

Trench Foot in the Armies.---The above data indicate that cold injury was primarily a problem of the armies in the field. However, when reported cases were distributed according to armies it was apparent that the Third Army had been involved to a much greater extent than others, that the rates for that unit were followed closely by those of the First Army, and that the Seventh and Ninth Armies had been relatively little involved. Figure 11.

The same variations which were demonstrated between armies likewise became evident when distribution was made by divisions. In the Third Army, some divisions had a consistently bad experience, the 26th Infantry for example, while that of others had been uniformly good, for example the 95th Infantry Division. As a general rule the armored divisions had much less trench foot than infantry divisions. Figure 12, Table 13.

The same behavior could be demonstrated for the First Army. Organizations such as the 30th Infantry were consistently free from trench foot. This was an old seasoned division that had long stressed the importance of trench foot as an infantry problem and had a well developed system of foot discipline. Their experience is to be contrasted with that of the 99th Infantry and the 106th Infantry. Here again the experience of armored divisions was satisfactory.

The Seventh Army included three seasoned divisions, the 3rd Infantry, 36th Infantry and 45th Infantry. In general all had a fairly satisfactory experience with trench foot. This was to be contrasted with the experience of the 44th Infantry a relatively new division.

Even the Ninth Army with relatively little trench foot as an army, showed the same variation among divisions.

Distribution by Regiments.---A number of studies were made of the variation in incidence between regiments of divisions. If a unit with a generally satisfactory rate was examined, such as the 3rd Infantry Division, it was demonstrated that under similar circumstances of environment the 7th Infantry Regiment had almost no trench foot while rates for the 15th and 30th Regiments were decidedly great. Many similar examples could be cited.

Finally, there was a great variation between the battalions of regiments. The 346th Regiment of infantry had many cases of trench foot during a short period of active operations. Almost all were among men of the 1st Battalion, with the 2nd and 3rd Battalions essentially free from the condition. The lack of uniform occurrence of the disease suggested that a variety of factors entered into the production of trench foot, because environmental and other conditions were so variable in respect to units.

Factors Determining Incidence of Trench Foot:--Four major considerations entered into the production of trench foot. These were military operations, weather, clothing and equipment, and foot discipline (Figure 13). Various subdivisions of these factors are set forth in the following list.

- | | |
|-----------------------------|--------------------------|
| 1 Operational conditions | 2 Clothing and equipment |
| a. Military duties | Foot gear |
| Offensive operations | Winter clothing |
| Defensive operations | 3 Weather |
| Static operations | Cold |
| Reserve and rest areas | Wet |
| b. Terrain | 4 Foot Discipline |
| Mountains | Training |
| Swamps | Practice |
| River Crossings | Command Control |
| Plains | |
| c. Environment and exposure | |
| Trench or fox holes | |
| Tents | |
| Buildings | |
| d. Rotation of Combat duty | |

Early field investigations showed that excessive incidence could in rare instances be related to a single one of these factors, more commonly there were various combinations of two or three and sometimes all four were active. It thus became evident that the problems of a particular unit in respect to trench foot were more or less individualized and that the control of trench foot in the final analysis, and for a given unit, was largely a question of determining which factors were active and directing the necessary specific measures of prevention as indicated by such epidemiologic studies. To this end, groups of investigators were active in all four of the field armies.

Methods of Control.--When trench foot first appeared in rapidly developing numbers, it came so suddenly and the situation was so confused by the secrecy incident to the major military operations then under way, that while it was known generally that trench foot was occurring in most of the armies, the actual units affected were not known, nor could the center of the principal difficulty be determined. The problem of control was like that of a water-borne epidemic of typhoid. The immediate need was to institute general measures comparable to the chlorination of water. To accomplish this purpose action was taken along three lines. Energetic measures were taken by command to improve foot discipline. The

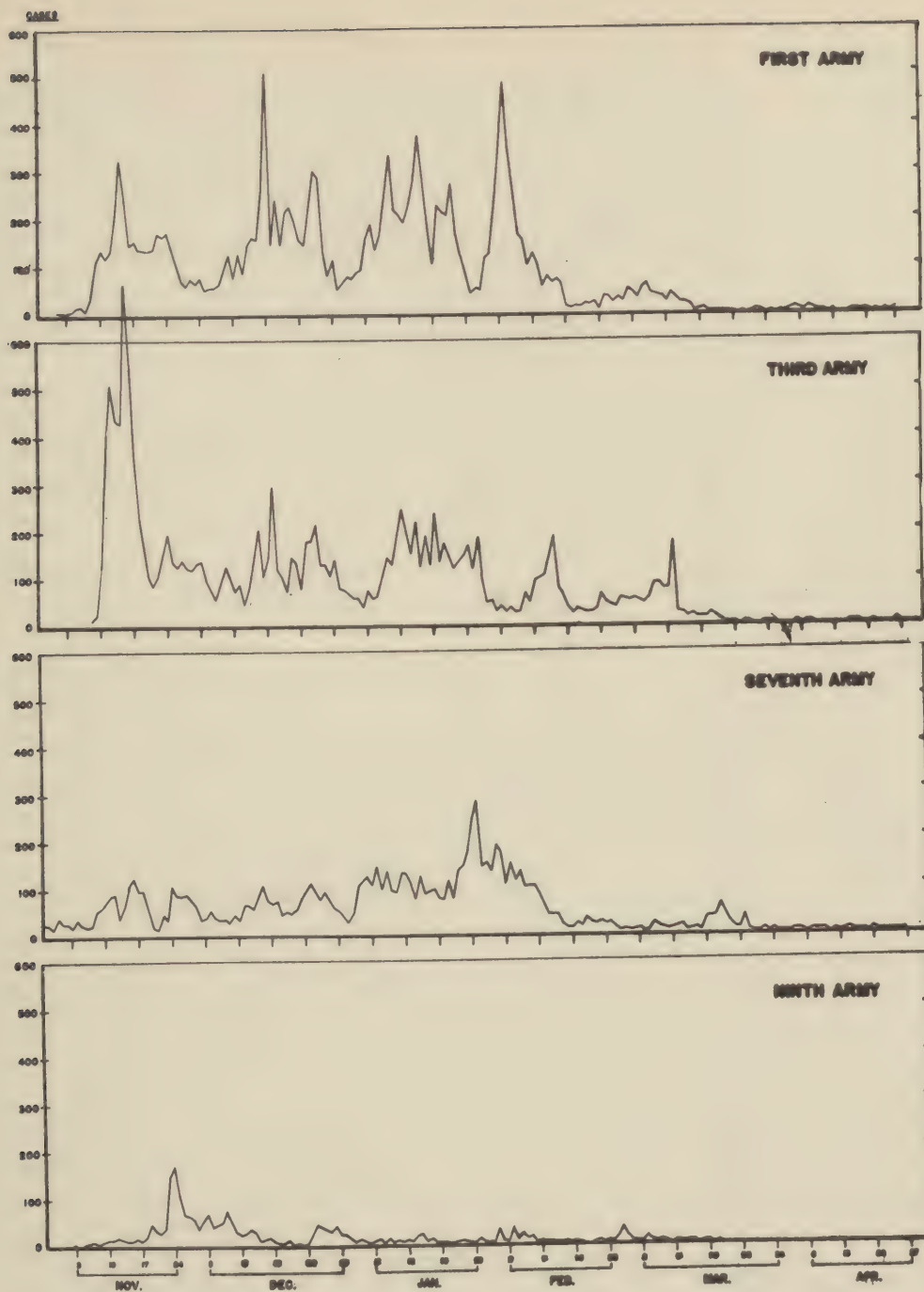


Figure 11

Cold injury, First, Third, Seventh and Ninth Armies, European Theater of Operations, daily admissions, 1 November 1944 to 27 April 1945, inclusive.

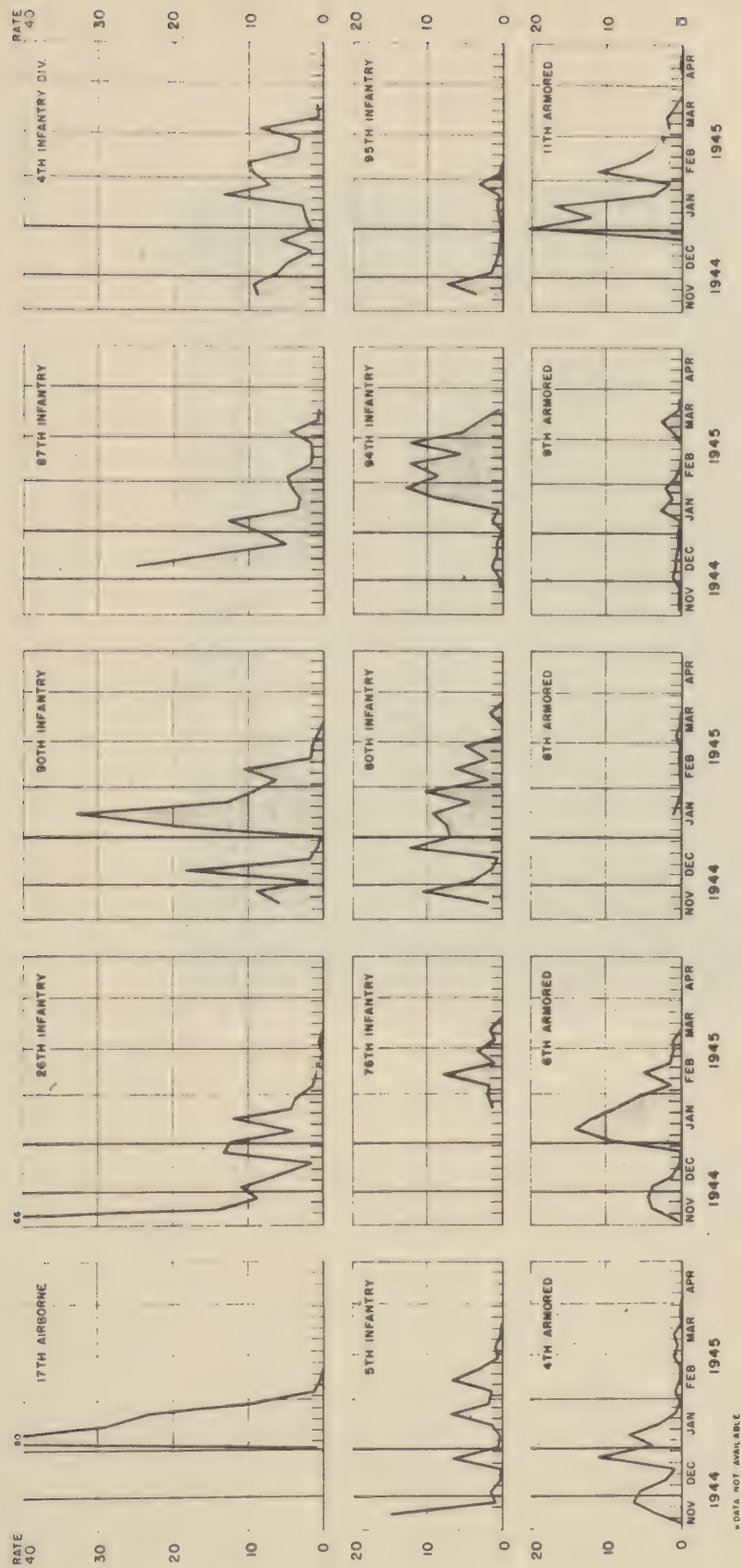


Figure 12

Cold injury, Divisions of the Third Army, European Theater of Operations, rates per week, 3 November 1944 to 27 April 1945, inclusive. (Divisions listed were assigned to Third Army, as of 1 February 1945.)



Figure 13

Dry clothing is frequently an impossibility
in front line fox holes, Ardennes Hills, February
1945.

Quartermaster Corps bent its energies to placing all available stocks of clothing in the hands of front line troops (Figure 14). The Medical Department undertook a campaign of public health education directed towards the individual soldier, making use of all available Army publications, such as Yank magazine, the Stars and Stripes, Army Talks and others; the use of posters, of the radio, and of movie shorts.

As the situation became clarified, the line of attack became more specific. Measures were directed towards determining those organizations most involved, the conditions which were producing trench foot and the determination of the necessary remedial measures. This work was done by the various divisions of Preventive Medicine of Armies, aided by investigators from the Office of the Chief Surgeon. The attack on the disease thus became direct and specific in contrast to the initial measures which were general and inclusive.

In January, Trench Foot Control Teams consisting of two officers, one from the line and one from the Quartermaster Corps, were established by each of the five field Armies. The teams, in conjunction with Army surgeons, worked with all units of the respective command down to the regimental level, investigating their specific problems and making recommendations on the spot for avoiding cold injury. Provision was also made for non-commissioned Trench Foot Officers at company level, who instructed the troops of the unit in preventive measures and instituted improved foot discipline.

Representatives of the theater division of Preventive Medicine visited all Armies and made careful studies of the basic causes underlying outbreaks of cold injury. The chain of command at all levels became fully aware of the danger of cold injury and cooperated to the fullest in bringing it under control. The Office of the Chief Quartermaster held a series of conferences in Paris with representatives of the Armies, Air Forces and other interested commands to decide upon types of winter clothing best suited for front line soldiers.

Experiences of other Armies with Trench Foot.--The First French Army, with the Seventh United States Army, constituted the Sixth Army Group. They were located in much the same territory. Operations were of a similar pattern and weather conditions were much alike. Their experience with cold injury closely paralleled that of the 7th Army. Table 14.

The British Army was singularly free from trench foot. From the beginning of operations on the continent until 1 January only 44 cases were reported, of which six were in the Canadian Army and the balance among troops of the Second British Army. The rate was so low as to make it worthless to present the data in detail.

Summary.--Trench foot developed in the European Theater of Operations in excessive numbers in November, and early energetic attack led to a marked reduction in incidence. The December counter-offensive of the German Army brought about a second wave of incidence. The number of cases was great and the causes lay in the general military situation. There was no doubt that the practice of preventive measures suffered because of the need of primary attention to combat activities. The latter part of December and early January showed a recrudescence of trench foot. This was in considerable measure due to the cold weather. It was also likely due in small part to acceptance of trench foot as an inevitable part of military operations in winter. More sustained and energetic control measures were indicated.

Trench foot was a serious problem in the experience of the theater. Of each 100 battle casualties, 80 were expected to return to combat duty. Trench foot led to much greater loss of man power with the best estimates that not more than half returned to combat duty.

In evaluating the various factors which gave rise to the disease during the winter of 1944 and 1945 it was the opinion of all that no one cause could be designated as the single exciting cause, but that several factors were inter-related and each of a different force under the varying circumstances under which it operated. It was a practical impossibility to single out any one. There was no magic cure or prevention. Trench foot control involved a combination of all relevant factors. With the type of warfare and under the conditions experienced in the ETO by the American Army, trench foot in a substantial amount was believed to have been an unavoidable hazard of war. The incidence could be reduced but not eliminated under the adverse conditions faced in Europe that winter. Under less severe conditions where fighting was less active, it might be possible with careful discipline, rotation of troops and suitable supplies to reduce trench foot to the point of almost complete elimination.



Figure 14

Parachute infantrymen of the 101st Airborne Division search for their size of overshoes, Bastogne, Belgium, January 1945.

Table 1

SCALES OF ACCOMMODATION
For Housing U. S. Army Personnel
In War Office Accommodations in the British Isles

Facilities	Basic Scale (Hutted) (18) (10)	Austerity Scale (Hutted) (19)	Winter Tenting (20) (26)	Summer Tenting	WAAC Scale
Living Quarters					
Officers, Sr.	150 S.F. (1)	72 S.F. (2)	64 S.F. (T) (9)	50 S.F. (T) (6)	150 S.F. (1)
Officers, Jr.	75 S.F. (2)	72 S.F. (2)	64 S.F. (T) (9)	50 S.F. (T) (6)	75 S.F. (2)
Sergeants	75 S.F. (2)	35 S.F. (7) (25)	35 S.F. (T) (10)	32 S.F. (T) (11)	75 S.F. (2)
Other Ranks	40 S.F. (5) (27) (25)	35 S.F. (7) (25)	35 S.F. (T) (10)	32 S.F. (T) (11)	Temp 56 S.F. (1) (22) STAND. 48 S.F. (4) (23)
Dining Rooms					
Officers, Sr. & Jr.	Approx 15 S.F. (26)	12 S.F.	10 S.F. (H)	10 S.F. (H)	100 S.F. plus 12 S.F. PER PERSON (29)
Sergeants	3½ S.F. (17)	3½ S.F. (17) (28)	3½ S.F. (H) (17)	3½ S.F. (H) (17)	100 S.F. plus 7 S.F. PER PERSON (29)
Other Ranks	3½ S.F. (17)	3½ S.F. (17) (28)	3½ S.F. (H) (17)	3½ S.F. (H) (17)	100 S.F. plus 7 S.F. PER PERSON
Kitchens					
Officers, Sr. & Jr.	Approx 15 S.F. (26)	12 S.F.	8 S.F. (H)	8 S.F. (H)	200 S.F. plus 5 S.F. PER PERSON (29)
Sergeants	3½ S.F. (26)	2 ¾ S.F.	2 S.F. (H) (15)	2 S.F. (H)	200 S.F. plus 3 S.F. PER PERSON (29)
Other Ranks	3½ S.F. (26)	2½ S.F.	2 S.F. (H) (15)	2 S.F. (H)	200 S.F. plus 3 S.F. PER PERSON (29)

Table 1

SCALES OF ACCOMMODATION
For Housing U. S. Army Personnel
In War Office Accommodations in the British Isles (Cont'd)

Facilities		Basic Scale (Hutted)(18)(10)	Austerity Scale (Hutted)(19)	Winter Tented (20)(26)	Summer Tented	WAAC Scale
Recreation - includes Institute Post Exchange, Social Rooms, etc.						
Officers, Sr. & Jr.		Approx 15 S.F. (26)	12 S.F.	10 S.F. (H)	7 S.F. (H)	100 S.F. plus 12 S.F. PER PERSON
	Sergeants	Approx 12 S.F. (26)	$3\frac{1}{2}$ S.F.	$3\frac{1}{2}$ S.F. (H) plus $\frac{1}{2}$ S.F. (T)	2 S.F. (T)	100 S.F. plus 7 S.F. PER PERSON
Other Ranks	Scale A	Scale B				
	$3\frac{1}{2}$ S.F. (26) 9 S.F. (31) (30)	$3\frac{1}{2}$ S.F. (H) plus $\frac{1}{2}$ S.F. (T)	$3\frac{1}{2}$ S.F. (H) plus $\frac{1}{2}$ S.F. (T)	2 S.F. (T)	100 S.F. plus 7 S.F. PER PERSON	
Baths						
Officers, Sr. & Jr.		10% SHOWERS	8% SHOWERS	10% SHOWERS (H)	10% SHOWERS (H)	10% TUBS - with shower over each tub
	Sergeants	5% SHOWERS	$2\frac{1}{2}$ % SHOWERS	$3\frac{1}{2}$ % SHOWERS (H)	$3\frac{1}{2}$ % SHOWERS (H)	$4\frac{1}{2}$ % SHOWERS plus $3\frac{1}{2}$ % TUBS (16)
Other Ranks		$3\frac{1}{2}$ % SHOWERS	$2\frac{1}{2}$ % SHOWERS	$3\frac{1}{2}$ % SHOWERS (H)	$3\frac{1}{2}$ % SHOWERS (H)	$4\frac{1}{2}$ % SHOWERS plus $3\frac{1}{2}$ % TUBS (16)
Ablutions						
Officers, Sr. & Jr.		12% Basins (14)	12% Basins (32)	12% Basins (H)(14)	12% Basins (H)(14)	20% Basins
	Sergeants	8% Basins (14)	8% Basins (32)	8% Basins (CS)(14)	8% Basins (CS)(14)	14% Basins (34)
Other Ranks		8% Basins (14)	8% Basins (32)	8% Basins (CS)(14)	8% Basins (CS)(14)	14% Basins (34)

Table 1

SCALES OF ACCOMMODATION

For Housing U. S. Army Personnel

In War Office Accommodations in the British Isles (Cont'd.)

Facilities	Basic Scale (Hutted)(18)(10)	Austerity Scale (Hutted)(19)	Winter Tented (20)(26)	Summer Tented	WAAC SCALE
Water Closets or Latrine Seats					
Officers, Sr. & Jr.	15%	15% (33)	15% (CS)	15% (CS)	20%
Sergeants	10%	5% (33)	5% (CS)	5% (CS)	12½%
Other Ranks	5%	5% (33)	5% (CS)	5% (CS)	12½%
Urinals					
All Ranks	4% (13)	4% (13)	4% (CS)(13)	4% (CS)(13)	
Infirmary					
All Ranks	1½ S.F. (1% Beds)(26)	1½ S.F. (1% Beds) 1½ S.F. (H)(1% Beds)	1½ S.F. (H) plus ¾ S.F. (H) (1% Beds)	¾ S.F. (H) plus ¾ S.F. (H) (1% Beds)	2% Beds
Drying Rooms					
All Ranks	1 S.F.	¾ S.F.	1 S.F. (H)	1 S.F. (H)	1 S.F.
Office Space					
All Ranks	2½ S.F. (26)	2 S.F.	1½ S.F. (H) plus ¾ S.F. (T)	¾ S.F. (H) plus 1½ S.F. (T)	Approx 2½ S.F.
Storage Space					
All Ranks	4 S.F. (26)	3½ S.F.	3½ S.F. (T)	3½ S.F. (T)	Approx 5 S.F.
Miscellaneous Buildings					
All Ranks	3 S.F. (26)	2½ S.F.	2½ S.F. (T)	2½ S.F. (T)	Approx 3 S.F. (12)

Source: Corps of Engineers, Headquarters ETOUSA.

Table 1

SCALES OF ACCOMMODATION (Cont'd)

NOTES

- T - Accommodation in Tents.
H - Accommodation in Huts.
CS - Accommodation in Camp Structures.
- (1) 4 per 16' x 36' hut.
 - (2) 8 per 16' x 36' hut.
 - (3) 10 per 16' x 36' hut.
 - (4) 12 per 16' x 36' hut.
 - (5) 14 per 16' x 36' hut.
 - (6) Maximum of two officers per 9' x 9' small wall tent.
 - (7) 16 per 16' x 36' hut.
 - (8) 18 per 16' x 36' hut.
 - (9) 4 per 16' x 16' pyramidal tent.
 - (10) 7 per 16' x 16' pyramidal tent.
 - (11) 8 per 16' x 16' pyramidal tent.
 - (12) 1 1/2 sq. ft. included for laundry and ironing space.
 - (13) 2' lengths of trough constitutes one urinal.
 - (14) 8 basins per standard 9' beach.
 - (15) Space for mess kits wash up and servery in Camp Structures.
 - (16) Showers in cubicles.
 - (17) Based on full capacity of camp. Troops fed in two sittings.
 - (18) Basic scale will be used in all cases where available accommodations and conditions permit. All new hutted construction will be carried out on this basis except Living Quarters. New construction for Living Quarters will be carried out on austerity scale.
 - (19) Austerity scale will be used when required in increasing the capacity of an existing installation that has been constructed on a higher scale, and is the construction of new Living Quarters only. Scales other than Living Quarters, will be considered absolute minimum, and will be applied only when conditions demand.
 - (20) Winter tented scale will be used to provide housing during the period 15 Oct to 15 Mar when hutted accommodation cannot be made available.
 - (21) Summer tented scale will be used to provide housing during the period 15 Mar to 15 Oct when hutted accommodation cannot be made available.
 - (22) Temporary scale to be used until such time as full contingent of W.A.A.C. personnel will be stationed in U.K.
 - (23) Standard scale to be used for construction planning purposes, for overall program, and for use in housing full contingent.
 - (24) Calculated on basis approved by Chief Surgeon for increasing capacities of existing installations (see incl. #4 herewith).

- (25) For double bunking a scale of 400 cu. ft. per man and 60 sq. ft. per double bunk may be used in lieu of scale given for all types of housing except metal Nissen and curved asbestos huts. No change will be allowed in scale for double bunking in Nissen and curved asbestos huts.
- (26) Calculated from approved drawings and schedules for standard installations. Subject to some variance for different size installations.
- (27) See British W. O. letter 118/General 4457 (F.W.2) Jun 1943 regarding increase in capacity of M.O.W. huts.
- (28) In expanding existing installations, existing mess halls may be supplemented with tents to bring messing facilities within required scale.
- (29) When officer personnel assigned to a camp is less than 10, officers will cook and mess with enlisted personnel. When officer and enlisted cooking and messing are combined, allotment of space will include only one basic allowance figure, i.e. for five officers and fifty enlisted personnel, the messing facilities (kitchen plus dining room) will be 300 sq. ft. plus (5 officers x 17 = 85 sq. ft.) plus (50 E. M. x 10 = 500 sq. ft.) = 885 sq. ft.
- (30) Scale A - applies in cases where N.A.A.F.I. Institute is not used.
- (31) Scale B - applies when N.A.A.F.I. is used - see Engineer Bulletin #15, 22 Mar 1943, and previous bulletins referred to therein.
- (32) In expanding existing installations, additional ablution facilities may be provided in tents or camp structures, sited as near as possible to existing ablutions. In such cases, only benches will be provided for the use of portable basins, 1 - 9' bench accommodating 8 basins. In all cases practicable, water will be supplied from taps in existing ablutions, and will not be piped to these supplementary ablutions. Hot water may be supplied from Soyer stoves where required. Where such supplementary facilities are provided in the above manner, 10% basic space will be allowed E. M. in lieu of 8% shown.
- (33) In expanding existing installations, bucket latrines in camp structures or tents may be used to supplement existing facilities.
- (34) In addition to lavatory basins shown, 2% sinks or additional lavatories will be provided for laundry.
- (35) All scales are given on a per person basis except scales expressed in percent. Facilities to be provided under percent scale are determined by applying percentage to over-all contingent.

Table 2

Deaths due to Alcohol Poisoning and Acute Communicable Diseases,
All troops on the Continent, European Theater of Operations, U. S. Army,
Number by months, and rates per 1000 per annum.

October 1944 to June 1945 Inclusive

Month	Cause of Death	
	Alcohol Poisoning	Acute Communicable Diseases
1944 October	2	7
November	1	7
December	3	16
1945 January	3	12
February	11	16
March	5	28
April	38	30
May	82	18
June	33	28
Total	178	162
Rate	0.12	0.11

Source: Division Preventive Medicine, Office of The
Chief Surgeon, European Theater of Operations,
U. S. Army.

Table 3

Selected Preventable Causes of Non-battle Injuries,
European Theater of Operations, U.S. Army,
February 1942 to March 1944, inclusive

Cause of Accident	Percent of non-battle injuries where patient was returned to duty			Percent of non-battle injuries requiring evacuation to Z of I			Deaths		
	Jan-Mar 1944			Jan-Mar 1944			1942 1943 1944		
	1942	1943	1944	1942	1943	1944	1942	1943	1944
Motor vehicle accidents	9.4	7.9	6.2	17.2	21.8	19.0	18.2	12.9	17.7
Tank and Tractor accidents	0.5	0.3	0.4	2.9	0	0	0	0.4	0.9
Bicycle accidents	2.9	5.1	2.9	2.3	7.6	6.0	1.6	1.2	0.5
Other road accidents	1.0	0.8	0.3	2.9	2.2	0	0	2.2	2.6
Air transport accidents	2.3	3.5	2.2	0.6	5.5	1.0	39.6	54.2	44.0
Firearms	2.9	2.2	1.3	17.8	15.3	13.0	13.0	8.5	21.7
Machinery	1.0	1.6	0.9	1.1	5.5	1.0	0.5	0.6	0
Burns	0.6	0	0.9	0	0	0	0	0	0
Total	20.6	21.4	15.1	44.8	57.9	40.0	72.9	80.0	87.4

Source: Division of Preventive Medicine, Office of the Chief Surgeon, European Theater of Operations
U. S. Army

Table 4

Ten Most frequent Causes of Non-battle Injuries,
European Theater of Operations, U.S. Army,
Cases and percent of total injuries, 1943.

Type of accident	Cases	Percent
Accidental injury by falls	3719	14.9
Accidents occurring in athletics, sports and recreation	2652	10.6
Motor vehicle accidents	1963	7.9
Running, jumping, twisting turning, lifting, slipping, etc.	1937	7.8
Bicycle accidents	1259	5.1
Accidental injury by crushing	983	3.9
Accidents occurring in drilling or marching	917	3.7
Striking on object	855	3.4
Fighting	768	3.1
Heat	716	2.9

Source: Division of Medical Records, Office of the Chief
Surgeon, European Theater of Operations, U.S. Army.

Table 5

Chief Reasons for Evacuation of Non-Battle Injuries to the
Zone of Interior, European Theater of Operations,
U. S. Army, 1943.

Type of Accident	Case
Motor vehicle accidents	62
Accidental injury by falls	43
Bicycle accidents	21
Accidents occurring in athletics, exercises, sports and recreation	15
Accidents involving marching	15
Air transport accidents	15
Other accidents	104
Total	275

Source: Division of Medical Records, Office of the
Chief Surgeon, European Theater of Operations,
U.S. Army

Table 6

Major Causes of Accidental Deaths,
European Theater of Operations, U. S. Army,
Number and percent of total deaths, 1943.

Type of accident	Number	Percent of total deaths
Air transport accidents	411	54.5
Motor vehicle accidents	105	13.0
Accidental injury by firearms	69	8.5
Accidental drowning	20	2.5
Other and unspecified road transport accidents	18	2.2
Accidental injury by falls	15	1.9
Water transport accidents	14	1.7
Other accidents	127	15.7
Total	809	100.0

Source: Division of Medical Records, Office of the Chief
Surgeon, European Theater of Operations, U.S. Army.

Table 7

Non-battle Injuries,
Exclusive of Fatal Cases and Evacuations to the Zone of Interior,
by Arm or Service, European Theater of Operations, U. S. Army,
20 percent sample of individual sick and wounded records,
January to March 1944, inclusive

Arm or Service	Cases
Adjutant General's Department	1
Military Intelligence	2
Women's Army Corps	2
Air Force, general or unspecified	94
" " combat units	142
" " transportation units	25
" " auxiliary units	6
" " service units	105
Medical Department, enlisted men	74
" " officers	1
" " Army Nurse Corps	13
Infantry, general or unspecified	265
" airborne	1
" parachute troops	65
" Rangers	6
Ordnance, general or unspecified	99
" ammunition	11
" aviation	11
Cavalry, general or unspecified	6
" armored troops	2
" other organized units	18
Coast Artillery, anti-aircraft units	41
Engineers, general or unspecified	178
" combat	28
" bridge pontoon units	8
Field artillery	54
Chemical Warfare Service	32
Armored Forces*	51
Tank Destroyer Forces*	18
Military Police	38
Quartermaster Corps	125
Signal Corps	60
Transportation Corps	47
Unassigned or not recorded	64
Total	1693

* Incomplete information

Source: Division of Medical Records, Office of the Chief Surgeon,
European Theater of Operations, U.S. Army.

Table 8

Accidental Deaths,
by Arm or Service, European Theater of Operations, U.S. Army,
January to March 1944, inclusive

Arm or Service	Deaths
Adjutant General's Department	1
Finance Department	1
Air Force, general or unspecified	40
" " combat units	135
" " transport units	30
" " auxiliary units	5
" " service units	15
Medical Department, enlisted men	7
Infantry, general or unspecified	19
" airborne	2
" parachute troops	4
" Rangers	1
" mechanized units	2
Ordnance, general or unspecified	7
" ammunition	1
" aviation	1
Cavalry, general or unspecified	1
" armored troops	1
" other mechanized units	1
Coast artillery, anti-aircraft units	6
Engineers, general or unspecified	31
" combat units	38
Field Artillery	17
Armored Forces*	5
Tank Destroyer Forces*	5
Military Police	8
Quartermaster Corps	23
Signal Corps	8
Transportation Corps	3
Unassigned and not recorded	5
Total	423

* Incomplete information

Source: Division of Medical Records, Office of the Chief Surgeon,
European Theater of Operations, U. S. Army.

Table 9

COLD INJURY

Armies of the European Theater of Operations
Admission by days
November 1944 to April 1945, inclusive

Date	Total*	1st Army	3rd Army	7th Army	9th Army	15th Army
1944						
28 Oct.	28	0		28		
29	26	0		26		
30	16	0		16		
31	39	0		39		
1 No	33	6		27		
2	34	6		28		
3	26	5		20	1	
Total	202	17		184	1	
4 Nov.	44	7		37	0	
5	41	14		26	1	
6	43	15		21	7	
7	37	7		21	9	
8	103	34	11	52	6	
9	199	110	21	59	9	
10	347	135	129	70	13	
Total	814	322	161	286	45	
11 Nov.	601	118	387	83	13	
12	738	132	501	86	19	
13	683	203	432	33	15	
14	820	324	424	61	11	
15	1086	247	719	109	11	
16	829	146	543	122	18	
17	606	154	350	91	11	
Total	5363	1324	3356	585	98	
18 Nov.	479	138	228	94	19	
19	399	137	163	53	46	
20	286	133	102	19	32	
21	262	138	82	13	29	
22	358	171	103	47	37	
23	498	164	157	31	146	
24	640	171	192	108	169	
Total	2922	1052	1027	365	478	
25 Nov.	468	139	135	85	109	
26	384	108	125	83	68	
27	359	71	138	86	64	
28	316	61	120	77	58	
29	295	76	119	62	38	
30	285	64	131	33	57	
1 Dec.	320	79	135	39	67	
Total	2427	598	903	465	461	

Table 9 - Cold Injury. (Continued)

Date	Total*	1st Army	3rd Army	7th Army	9th Army	15th Army
2 Dec.	239	51	95	53	40	
3	215	57	76	38	44	
4	194	57	56	32	49	
5	254	62	83	34	75	
6	300	93	127	29	51	
7	303	127	101	45	30	
8	203	77	71	31	24	
Total	1708	524	609	262	313	
9 Dec.	307	129	87	65	26	
10	230	87	43	66	34	
11	310	144	79	58	29	
12	403	161	146	86	10	
13	478	158	201	105	14	
14	458	265	103	72	18	
15	728	507	142	69	10	
Total	2914	1451	801	521	141	
16 Dec.	521	146	292	73	8	
17	407	240	117	43	7	
18	308	146	100	50	12	
19	330	212	71	45	2	
20	425	225	143	51	6	
21	409	199	133	76	1	
22	329	154	77	94	4	
Total	2729	1322	933	434	40	
23 Dec.	458	146	176	110	26	
24	547	232	177	95	43	
25	624	300	212	72	40	
26	537	285	127	90	35	
27	369	133	129	78	29	
28	280	80	102	58	40	
29	326	113	137	51	25	
Total	3141	1289	1060	554	238	
30 Dec.	193	51	79	40	23	
31	184	66	75	29	14	
1945						
1 Jan.	202	79	65	49	9	
2	241	72	57	101	11	
3	267	87	58	113	9	
4	254	92	37	122	3	
5	341	158	73	102	8	
Total	1682	605	444	556	77	

Table 9 - Cold Injury. (Continued)

Date	Total*	1st Army	3rd Army	7th Army	9th Army	15th Army
6 Jan.	401	188	57	143	13	
7	291	132	60	96	3	
8	416	168	102	132	14	
9	485	241	143	94	7	
10	561	333	128	90	10	
11	545	216	192	130	7	
12	591	209	242	130	10	
Total	3384	1487	924	815	64	94**
13 Jan.	512	190	205	110	7	
14	473	228	150	76	19	
15	646	282	217	125	22	
16	595	377	121	88	9	
17	601	309	187	93	12	
18	405	175	128	97	5	
19	420	103	234	78	5	
Total	3652	1664	1242	667	79	0
20 Jan.	441	228	133	75	5	
21	505	214	172	117	2	
22	432	208	145	76	3	
23	537	272	120	139	6	
24	445	163	133	142	7	
25	448	121	144	178	5	
26	505	85	169	247	4	
Total	3313	1291	1016	974	32	0
27 Jan.	464	43	119	289	13	
28	386	53	185	142	6	
29	307	48	102	153	4	
30	303	118	47	134	4	
31	397	126	50	190	31	
1 Feb.	445	238	27	172	8	
2	499	347	37	108	7	
Total	2802	973	567	1188	73	1**
3 Feb.	700	484	27	153	36	
4	502	343	36	112	11	
5	439	250	28	139	22	
6	307	165	29	100	13	
7	337	154	67	101	15	
8	255	101	49	101	4	
9	311	125	91	89	6	
Total	2851	1622	327	795	107	0

Table 9 - Cold Injury. (Continued)

Date	Total*	1st Army	3rd Army	7th Army	9th Army	15th Army
10 Feb.	287	103	99	69	5	11
11	219	59	102	44	5	9
12	288	81	147	47	4	9
13	307	67	189	46	1	4
14	178	72	77	22	4	3
15	151	66	64	17	1	3
16	103	34	37	17	8	7
Total	1538	482	715	262	28	46
17 Feb.	66	16	24	25	1	0
18	62	11	32	19	0	0
19	82	16	30	36	0	0
20	69	14	26	27	2	0
21	75	20	28	22	5	0
22	80	18	34	27	1	0
23	116	22	65	22	7	0
Total	550	117	239	178	16	0
24 Feb.	85	9	47	24	5	0
25	108	38	40	15	15	0
26	115	35	38	8	34	0
27	106	23	56	10	16	1
28	101	34	53	8	6	0
1 Mar.	78	26	40	8	4	0
2	108	51	46	10	1	0
Total	701	216	320	83	81	1
3 Mar.	107	45	40	5	17	0
4	87	33	36	9	8	1
5	131	55	47	25	3	1
6	166	63	77	18	8	0
7	137	40	78	16	3	0
8	112	37	65	10	0	0
9	118	36	67	12	3	0
Total	858	309	410	95	42	2
10 Mar.	217	24	176	15	2	0
11	88	42	25	20	1	0
12	66	34	24	6	2	0
13	49	24	16	8	1	0
14	53	23	20	10	0	0
15	42	19	15	7	1	0
16	56	2	17	36	1	0
Total	571	168	293	102	8	0

Table 9 - Cold Injury. (Continued)

Date	Total*	1st Army	3rd Army	7th Army	9th Army	15th Army
17 Mar.	58	7	15	36	0	0
18	75	10	26	38	1	0
19	79	2	13	64	0	0
20	60	3	9	48	0	0
21	33	2	2	29	0	0
22	16	2	1	13	0	0
23	14	1	2	11	0	0
Total	335	27	68	239	1	0
24 Mar.	39	1	0	38	0	0
25	11	0	2	8	0	1
26	6	1	2	3	0	0
27	2	0	0	2	0	0
28	12	1	0	10	0	1
29	11	7	1	3	0	0
30	14	4	1	9	0	0
Total	95	14	6	73	0	2
31 Mar.	4	0	1	3	0	0
1 Apr.	4	1	0	3	0	0
2	1	0	0	1	0	0
3	8	3	0	5	0	0
4	6	1	0	5	0	0
5	16	9	2	5	0	0
6	13	12	0	1	0	0
Total	52	26	3	23	0	0
7 Apr.	15	8	2	5	0	0
8	12	5	1	6	0	0
9	17	12	0	5	0	0
10	10	6	0	4	0	0
11	2	2	0	0	0	0
12	5	2	0	3	0	0
13	0	0	0	0	0	0
Total	61	35	3	23	0	0
14 Apr.	4	1	0	3	0	0
15	9	0	0	9	0	0
16	3	0	1	2	0	0
17	2	0	1	1	0	0
18	5	3	1	1	0	0
19	1	1	0	0	0	0
20	9	1	0	8	0	0
Total	33	6	3	24	0	0

Table 9 - Cold Injury. (Continued)

Date	Total*	1st Army	3rd Army	7th Army	9th Army	15th Army
21 Apr.	6	3	1	2	0	0
22	3	0	0	3	0	0
23	2	1	0	1	0	0
24	2	0	0	2	0	0
25	4	2	0	2	0	0
26	10	0	8	2	0	0
27	8	6	0	2	0	0
Total	35	12	9	14	0	0
Total	44228	16953	15439	9767	2423	146

* Cases among troops assigned and attached to Headquarters, Sixth and Twelfth Army Groups not included.

** Daily distribution not available.

Source: Division of Preventive Medicine, Office of the Chief Surgeon
European Theater of Operations, U. S. Army.

Table 10

COLD INJURY
Armies of the European Theater of Operations
Rates per 1000 strength per annum, by weeks,
November 1944 to April 1945, inclusive.

Week ending	Total*	1st Army	3rd Army	7th Army	9th Army	15th Army
1944						
3 Nov.	12.3	3.1		51.9	0.4	
10	46.4	55.7	32.7	75.5	14.7	
17	260.0	184.1	591.7	152.0	25.0	
24	160.2	172.7	214.8	94.9	135.7	
Total	127.7	110.9	224.4	94.5	47.5	
1 Dec.	130.5	98.5	186.3	116.8	124.6	
8	92.2	85.3	127.5	67.8	83.8	
15	154.0	223.2	168.8	127.7	39.2	
22	142.0	192.3	190.8	100.6	12.7	
29	154.7	214.1	174.6	116.1	69.3	
Total	135.2	164.0	170.0	106.4	67.8	
1945						
5 Jan.	79.6	96.1	66.8	112.8	23.7	
12	158.2	238.0	141.9	166.7	19.1	233.0
19	170.9	270.6	184.6	130.9	23.5	- -
26	149.3	213.0	149.3	165.0	9.5	- -
Total	139.8	203.9	135.9	144.7	18.9	187.5
2 Feb.	124.4	168.8	86.1	192.1	19.6	3.7
9	123.9	299.5	53.7	126.1	22.4	- -
16	66.5	88.0	119.6	42.1	5.6	136.0
23	24.1	21.5	40.9	31.3	2.9	- -
Total	84.9	144.5	75.4	99.3	11.7	49.0
2 Mar.	29.0	35.6	52.4	15.3	13.7	1.4
9	34.6	50.8	66.7	17.7	7.0	1.8
16	22.0	27.5	49.2	16.1	1.3	- -
23	12.4	4.4	10.6	36.4	0.2	- -
30	3.5	2.3	1.0	11.0	0.0	1.0
Total	17.8	23.9	35.9	19.5	4.3	.7
6 Apr.	1.9	4.3	.5	3.9	0.0	
13	2.3	5.9	.5	3.9	0.0	
20	1.1	.9	.4	4.0	0.0	
27	1.2	1.9	1.3	2.3	0.0	
Total	1.6	3.2	.7	3.5	- - -	
GRAND TOTAL	76.1	106.8	99.8	72.2	20.2	14.2

* Cases among troops assigned and attached to Headquarters, Sixth and Twelfth Army Groups not included.

Source: Division of Preventive Medicine, Office of the Chief Surgeon, European Theater of Operations, U. S. Army.

Table 11

Frostbite
All Armies, European Theater of Operations,
Cases and rates per 1000 strength per annum, by weeks,
November 1944 to April 1945 inclusive

Week Ending	Cases	Rate
1944		
3 November	0	0
10	0	0
17	0	0
24	0	0
1 December	0	0
8	1	0.1
15	22	1.2
22	1	0.1
29	41	2.0
1945		
5 January	142	6.7
12	392	18.3
19	1024	47.9
26	1135	51.1
2 February	788	35.0
9	1186	52.4
16	388	14.7
23	68	3.0
2 March	58	2.4
9	91	3.7
16	34	1.3
23	17	0.6
30	0	0
6 April	2	0.1
13	8	0.3
20	11	0.4
27	9	0.3
Total	5368	9.14

Source: Division of Preventive Medicine, Office of the
Chief Surgeon, European Theater of Operations,
U.S. Army.

Table 12

Cold Injury

Major Commands on the Continent,

European Theater of Operations, U. S. Army

Cases and Rates per 1000 Strength per Annum, by Months
November 1944 to April 1945, Inclusive

Month	Ground Forces		GFRG		Com Z		Air Force		Total Continent	
	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate
November	9328	125.2	2	0.3	10	0.3	10	0.7	9350	75.1
December	13024	132.2	115	17.0	57	1.5	20	1.0	13216	80.7
January	12140	136.0	236	33.1	122	3.5	48	3.1	12546	85.3
February	8017	83.4	176	25.0	159	4.3	13	0.8	8365	53.1
March	2593	18.6	86	8.3	12	0.3	2	0.1	2693	12.2
April	181	1.6	19	1.9	8	0.2	22	1.2	230	2.1
Total	45283	75.9	634	13.2	368	1.8	115	1.1	46400	46.6

Source: Divisions of Preventive Medicine and Medical Statistics, Office of the Chief Surgeon, European Theater of Operations, U. S. Army.

Table 13

Cold Injury
Divisions of the Third Army.*
European Theater of Operations
Rates per 1000 Strength per Week,
3 November 1944 to 27 April 1945, Inclusive

Week Ending	4th Inf.	5th Inf.	26th Inf.	76th Inf.	80th Inf.	87th Inf.	90th Inf.	94th Inf.	95th Inf.	4th Arm'd	6th Arm'd	8th Arm'd	9th Arm'd	11th Arm'd	17th A/B
1944															
17 Nov	10.11	0	66.43		0		0	0	0	0	0		.08		0
24 "	8.73	14.11	13.82		1.89		5.72	0	3.59	3.43	3.81		.17		0
1 Dec	9.49	1.06	8.74		10.55	0	9.01	.25	7.44	6.27	4.38		.17		0
8 "	6.44	1.59	11.00		3.87	0	2.11	.51	1.69	5.43	3.59		.89		0
15 "	4.93	.26	6.31		1.45	24.60	18.21	.76	.94	2.06	1.01		.71	0	0
22 "	1.74	.11	1.65		.57	14.40	2.82	.57	.50	.75	.17		.64	0	0
29 "	5.57	6.36	13.28		12.31	4.87	.71	.70	.31	11.11	.08		.39	.09	0
1945															
5 Jan	1.52	.66	12.40		6.79	8.21	.18	.14	.18	6.69	9.49		.51	20.39	1.01
12 "	2.44	.31	12.77		7.46	12.54	19.73	1.27	.41	6.58	14.36		.11	12.02	80.04
19 "	2.63	1.41	11.99		9.43	3.52	32.77	.49	.54	2.77	11.98	0	2.60	16.85	28.80
26 "	13.16	7.07	4.42	1.32	4.27	3.13	12.95	8.87	.36	.51	8.33	.36	.99	3.66	23.43
2 Feb	7.26	1.75	3.94	1.90	10.21	4.15	9.45	12.90	3.23	.17	5.66	0	1.87	1.47	9.34
9 "	9.63	1.38	1.58	1.63	1.99	4.59	6.34	8.55	.25	.70	1.28	.09	.75	11.18	11.32
16 "	10.03	6.61	.90	7.74	6.32	1.65	10.38	12.24	0	.17	5.07	.09	.09	6.20	.24
23 "	3.43	2.95	**	.90	2.12	1.50	1.67	5.45	.18	.09	1.30	.09	0	3.97	0

Table 13 (Cont'd)

Cold Injury
Divisions of the Third Army,*
European Theater of Operations,
Rates per 1000 strength per Week,
3 November 1944, to 27 April 1945, inclusive.

Week Ending	4th Inf.	5th Inf.	26th Inf.	76th Inf.	80th Inf.	87th Inf.	90th Inf.	94th Inf.	95th Inf.	4th Arm'd	6th Arm'd	8th Arm'd	9th Arm'd	11th Arm'd	17th A/B
1945															
2 Mar	3.06	.44	0	3.30	4.78	1.58	1.58	11.97	0	.98	.94	.08	0	**	0
9 "	8.48	.75	.45	.95	.20	4.65	.70	5.32	.06	.35	1.04	.41	.77	1.62	0
16 "	.64	.25	.06	1.46	.06	.82	0	3.09	0	.95	0	.08	2.55	2.04	0
23 "	.57	.06	0	.13	1.70	.49	.06	.26	0	.17	0	0	0.24	.86	0
30 "	.06	0	0	0	0	0	0	0	0	.17	0	0	.24	0	.08
6 Apr	0	0	0	.07	.06	0	0	0	0	0	0	0	0	0'	0
13 "	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.24
20 "	0	0	0	0	0	0	0	0	0	0	0	0	0	.08	0
27 "	.06	0	0	0	0	0	0	0	0	0	0	0	0	0	0

*Divisions under Third Army Command as of 1 February 1945.

**No Report.

Source: Division of Preventive Medicine, Office of the Chief Surgeon, European Theater of Operations, United States Army.

Table 14

Cold Injury

First French Army, Sixth Army Group,
European Theater of Operations,
Cases and Rates per 1000 Strength per Annum, by Weeks,

5 October 1944 to 1 February 1945, Inclusive

Week Ending	Cases	Rate
1944		
5 October	31	9.5
12	110	30.0
19	330	82.7
26	171	43.8
2 November	123	29.8
9	105	24.5
16	662	158.0
23	907	219.6
30	285	69.2
7 December	426	103.8
14	497	118.7
21	574	137.7
28	582	245.3
1945		
4 January	346	82.0
11	323	71.0
18	377	83.0
25	1362	299.0
1 February	1355	341.0

Source: Division of Preventive Medicine, Office of the Chief Surgeon, European Theater of Operations, U. S. Army.

FIGURES

1. Soldiers on leave are quartered in resort hotels at the U.S. Recreational Center, Riviera, France, April 1945.
2. A Maginot Line pillbox serves as quarters, 6th Armored Division, Kappel, Germany, December 1944.
3. An improvised front line shower, 106th Infantry Division, February 1945.
4. New winter clothing is issued to the 8th Infantry Division Hurtgen Forest, Germany, January 1945.
5. Yanks capture a rathskeller in Borgel, Germany, January 1945.
6. An accident due to a skid on an icy bridge in Luxembourg, January 1945.
7. Cold Injury, 108th General Hospital, Paris, France, December 1944.
8. A Ninth Army tank bogged down by mud, November 1944.
9. Heavy machine gun fire pins down a combat patrol of the 2nd Infantry Division, Ondenval, Belgium, January 1945.
10. Cold Injury, all Armies, European Theater of Operations, daily admissions, 1 November to 27 April 1945, inclusive.
11. Cold Injury, First, Third, Seventh and Ninth Armies, European Theater of Operations, daily admissions, 1 November 1944 to 27 April 1945, inclusive.
12. Cold Injury, Divisions of the Third Army, European Theater of Operations, rates per 1000 strength per week, 3 November 1944 to 27 April 1945, inclusive. (Divisions listed were under Third Army command on 1 February 1945.)
13. Dry clothing is frequently an impossibility in front line fox holes.
14. Parachute infantrymen of the 101st Airborne Division search for their size of overshoes, Bastogne, Belgium, January 1945.

TABLES

1. Scales of Accommodation for housing. U.S. Army Personnel in War Office Accommodations in the British Isles.
2. Deaths due to Alcohol Poisoning and Acute Communicable Diseases, all troops on the continent, European Theater of Operations, U.S. Army, number by months and rates per 1000 strength per annum, October 1944 to June 1945, inclusive.
3. Selected Preventable Causes of Non-battle Injuries, European Theater of Operations, U. S. Army, February 1942 to March 1944, inclusive.
4. Ten most frequent causes of Non-battle Injuries, European Theater of Operations, U.S. Army, cases and rates per 1000 strength per annum and percent of total injuries, 1943.
5. Chief reasons for Evacuation of Non-battle Injuries to the Zone of Interior, European Theater of Operations, U.S. Army, 1943.
6. Major causes of Accidental Deaths, European Theater of Operations, U.S. Army, 1943.
7. Non-battle Injuries, exclusive of fatal cases and evacuations to the Zone of Interior, by Arm or Service, European Theater of Operations, U.S. Army, twenty percent sample of individual sick and wounded records, January to March, 1944, inclusive.
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A HISTORY OF PREVENTIVE MEDICINE
IN THE
EUROPEAN THEATER OF OPERATIONS
UNITED STATES ARMY
1941 - 1945

PART XI - The Integration of Preventive Medicine
with other Military and Civilian Activities

by

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PART XI

The Integration of Preventive Medicine with other Military and Civilian Activities

A consideration of common interests between the organized service for preventive medicine in the Medical Department and the many other agencies both in and out of the United States Army which had a part in that work, involves an appreciation of the fundamental philosophy that governs activities designed for the prevention of disease and the maintenance of health.

Preventive medicine is no independent discipline in the sense of chemistry or physics, nor even to the extent of physiology or anatomy among medical sciences. It is an intimate part of the whole structure of medical practice, and its accomplishments are largely determined by the extent and satisfactoriness with which its efforts are integrated with other branches of medical practice and into the whole fabric of military life.

A preventive medicine service of itself has the responsibility to develop methods for the limitation of disease; and to apply, direct, and supervise preventive measures within the community, be it military or civilian. To an appreciable extent it is a coordinating agency, for much of the work of prevention is necessarily and desirably done by organizations other than those concerned primarily with preventive medicine.

This concept of preventive medicine led inevitably to a close association of the Preventive Medicine Division in the European Theater with other professional and administrative divisions of the Office of the Chief Surgeon, with numerous other branches and arms of the service and with civilian agencies in public health. The closest relationship rightfully held with the Division of Professional Services in the Chief Surgeon's Office.

Division of Professional Services.---The practice of medicine perhaps functions most closely to the ideal when the physician is equally concerned with the care of the sick and the protection of the well. Even with specialized interests in either preventive or internal medicine, no sharp dividing line is desirable and in consideration of the two disciplines, it should be impossible to determine just where preventive medicine leaves off and where good curative medicine begins. While it is desirable administratively that the organization for the two be separate, still a unity of professional interests is essential if the objective, the health of the command, is to be attained.

Much of the success of a working arrangement that endured throughout the course of operations came from an understanding reached in the earliest days of the theater, between the Chief Medical Consultant of the Division of Professional Services and the Chief of the Preventive Medicine Division; an understanding and a definition of principles that came out of an afternoon in a British garden on the first Sunday in the life of the newly established headquarters in rural England.

Certain fields where treatment entered strongly into the program of control lent themselves to a fairly definite division of interests between medical management and preventive activities. Among these fields was that of venereal diseases (see Part V). Malaria was another example; the Professional Services Division was responsible for clinical management of patients and the application of suppressive treatment, and the Division of Preventive Medicine for mosquito control, the protection of hospitals from infestation, and for proper isolation precautions. The tuberculosis program likewise stressed the clinical features involved in case finding, and the preventive measures applied were directly under the supervision of the consultant in tuberculosis.

Interests such as trench foot were predominantly a matter of preventive medicine, but clinical study and clinical management as a means of limiting disability were so closely coordinated with the preventive program by the Chief Surgical Consultant that the term Division of Preventive Surgery, at first lightly expressed, to designate the surgical personnel of the Professional Services Division, came to approach reality as it desirably should.

Other mutual interests were less sharply divided. Diphtheria showed a measurably increased prevalence and a higher death rate in early 1945. The principal cause contributing to greater numbers of deaths was determined to be not so much an enhanced virulence of the infectious agent as too late recognition of the disease, and, as a consequence, of treatment that was too long delayed. The preventive measures were definitely related to improved clinical methods. On the other hand, no better illustration of a primary stimulus to epidemic control that originated from the clinical side could be brought forth than the observation by clinicians of a changing character in upper respiratory disease in 1943 which gave the first indication of a nascent influenza epidemic days before it became statistically apparent.

These pertinent and outstanding examples were wholly aside from the continuing but less significant affairs which entered into

the work of the day to such an extent that the services of each department were constantly called upon by the other and informal conferences between them were close to a daily occurrence. Colonel William S. Middleton, who served as Chief Medical Consultant in the European Theater for three years, has expressed the opinion that professional practice in the Theater demonstrated an integration of clinical and preventive interests which might well find broader application, a statement in which the writer joins with no reservations.

Corps of Engineers.--An outstanding feature of the practice of preventive medicine in this war was the extent to which non-medical specialists entered into the work. Prominent among these were sanitary engineers and nutritionists. Possessing a kind and quantity of training and experience in fields that were more or less foreign to the physician, they contributed to an improved performance in the control of water supplies, in waste disposal, mess management, nutrition, and in the general management of environmental sanitation. (Figure 1) These achievements in preventive medicine were attained, however, through close association with a number of other technical branches of the service, especially the Corps of Engineers and the Quartermaster Corps.

The operation of systems for water supply, sewage disposal and for general disposal of wastes was a function of the Corps of Engineers. The interest of the sanitary engineers in the preventive medicine service in these facilities was expressed through continuous consultation concerning specifications for their construction and in the program for their operation.

Many of the matters connected with military occupational hygiene (see Part X) were fundamentally related to activities of the Corps of Engineers; such things as housing, heating, ventilation, and other factors related to the personal comfort and health of troops. The changing requirements in scales of accommodation to meet altered conditions of military operations were always a joint consideration of Preventive Medicine and the Engineers. Specific control measures for some of the communicable diseases depended primarily upon the activities of the Engineers, such as rat control programs and operations for elimination of mosquitoes.

Quartermaster Corps.--If a man is well fed and well clothed, much has been accomplished in assuring that he remains healthy. These two objectives were responsibilities

of the Quartermaster Corps. In the accomplishment of their obligation, their relationships with the Medical Department were frequent and fundamental. The time is long since passed when the responsibility of a unit commander for the nutrition of his troops ends with seeing that they have what the Quartermaster allots, and the Quartermaster has extended his interests far beyond the question of supply. Quartermaster food laboratories have been developed, and Subsistence Divisions have extended their activities to mess management. The Nutrition Branch of the Preventive Medicine Division in the European Theater was concerned with the analysis and scientific appraisal of the ration, as well as with its palatability, with mess management and the avoidance of food wastage. The overlapping interests of the two organizations gave opportunity for much common and correlated effort, a circumstance which contributed pertinently to the high level of attainment in nutrition in the European Theater.

The development of a new winter uniform for the European Theater by the Quartermaster Corps was as well an intimate concern of the Division of Preventive Medicine. Clothing and equipment had a lot to do with the prevention of trench foot and influenced the rates for respiratory infection. The long series of conferences by members of the Quartermaster Corps which led to the final specifications were participated in by the Medical Department. The medical aspects were considered jointly with the technical details of supply, sizes, materials, and the many other considerations which entered into this major undertaking.

Perhaps the closest collaboration of the two services was in the field of louse control. The whole scheme of delousing underwent a fundamental change in method just before the problem of typhus fever developed, with the result that the careful planning which had entered into the project had to be in large part discarded because of the emergence of new and superior methods. This involved for the Quartermaster Corps not only the usual supply problem, but the training of Quartermaster units in the new methods which substituted, for the troops, dusting with DDT powder in place of bathing and, for the disinfection of equipment, the same chemical in a liquid or powder form in lieu of methyl bromide. (Figure 2) The training of Sterilization and Bath units in these methods was accomplished through the joint efforts of experts from the preventive medicine service, and the Quartermaster officers in charge of the units. The success of the project was demonstrated in the control of an epidemic of typhus fever in Germany, where these Quartermaster Corps units contributed to the limitation of the disease to an extent which has received too little credit.



Figure 1

Construction of a sewer line by the Engineer Corps, Wilton, England, 1943.



Figure 2

DDT powder for the prevention of the spread of typhus, 345th Quartermaster Depot Company, Herbesthal, Belgium, December 1944.

Office of the Provost Marshal.---Control of the venereal diseases has passed from a police activity to emphasis on education and the application of epidemiologic methods, in similar manner to the attack on the communicable diseases in general. However, to assume that the police functions have no longer a place in modern venereal disease control, discounts the material help secured from the Office of the Provost Marshal in application of the off limits policy, and its aid in the management of prostitutes. (Figure 3)

In time of active military operations, battle casualties assume a far greater importance than do non-battle injuries or even the need to control epidemics. A situation arises where attention to such prosaic affairs as automobile accidents and other commonplace hazards of Army life seems far apart from the main issue. The losses in manpower resulting from accidents nevertheless have been material.

The problem of accident prevention is not alone an obligation of the Provost Marshal as too many officers, both medical and other, are prone to assume. Accident prevention is definitely a part of a well conceived preventive medicine program. The Provost Marshal's department in the European Theater, although appreciating its primary responsibility in the matter, gave genuine cooperation to the limited efforts in the field that were made by the Preventive Medicine Division. Both organizations, however, might well have directed more energy to eliminating causes of disability from non-battle injuries, the results of which numbered essentially three fifths of the losses that came from battle casualties.

Civil Affairs.---The Public Health Section of the Civil Affairs Division was the preventive medicine organization for that part of Army activities directed towards the maintenance of health among civilians of liberated countries. As the Public Health Section of Military Government, it served a similar purpose for the civilians of conquered countries. (Figure 4)

No inconsiderable discussion arose in the course of operations, and again after the war was over, on the nature of a health organization to accomplish the obligations associated with military occupation of conquered countries. There is serious reason for combining into a single organization two activities---preventive medicine for troops and public health for civilians who become the wards of the army---which are identical in their aims and differ only in the populations to which they apply.

When this is not done, however, the closest cooperation between the two activities is necessary. The obligation to troops of protection from typhus fever cannot be accomplished satisfactorily if an epidemic among the civilians who surround the army is disregarded. Venereal disease is not a problem of an army but of a complete population. The army and civilians live in the same area and the environmental hygiene of that area is as closely related to the one as to the other.

The planning stage of civil affairs operations in England was characterized by much cooperative effort to develop preventive medicine procedures among displaced persons, refugees and the general civilian populations of liberated and occupied countries that would fit into the methods and supply programs of the Army.

Once operations began on the continent, the civil affairs organization more or less went its own way. Little was known in the Preventive Medicine Division about the activities of the Public Health Section of Civil Affairs, ETO, despite a conscientious liaison officer in the Office of the Chief Surgeon, whose duty it was to effect coordination between public health and preventive medicine in the two organizations. He was usually as uninformed as the rest of the Office of the Chief Surgeon.

The contact that did exist with civil affairs personnel was not on the operational plane at theater headquarters but at the policy making and supervisory level of Supreme Headquarters, SHAEF. The common efforts that came into play operationally, were exerted through the G-5 Section of the 12th Army Group and the corresponding staff sections of armies, and were largely brought about on an informal basis.

Policies governing venereal disease control, typhus control, the management of displaced persons, and many other features of civilian public health were some of the interests which brought together the Division of Preventive Medicine and the Public Health Section of G-5 SHAEF. Most directives issued at that level were first coordinated with the Office of the Chief Surgeon. The venereal disease control officer of G-5 SHAEF was for some months assigned on temporary duty to the Office. All in all, the arrangements that existed were satisfactory and gave suggestion of the possibilities that could have eventuated had the same situation held in all echelons. The fault doubtless lay in both directions but at least there was too general an attitude that each was independently created and intended to function that way.



Figure 3

The military police and gendarmes patrol the streets of Cherbourg, France, July 1944.



Figure 4

An Allied Civil Affairs unit, Verdun, France, September 1944.

Operationally, the preventive medicine service took a considerable part in the training of army and army group civil affairs organizations in preparation for typhus control, but other than that there was little joint effort. When typhus actually broke out, practical help was provided by the medical Department to G-5 organizations of armies, but the limitations in personnel and other factors were such that effective typhus control broke down and it became necessary for the Medical Department through all echelons to take direct responsibility for the control of all communicable diseases among civilians, an arrangement which persisted to the end of hostilities. The staff and resources of the Public Health Section came under direct control of Surgeons at the several levels of command and the standard of performance improved.

United States Navy.---The most cordial relations existed between the headquarters of the Navy and of the Army in the European Area but in preventive medicine the number of common interests was minimal. The part of the Navy in the European Theater was relatively small, compared with that taken in other theaters of operation.

A few such affairs as the sanitary control of ports required joint decision, but mutual interests were more or less limited to exchange of opinion on professional subjects as they influenced individual problems of the two services.

British Military Organizations.---Among the differences in organization between the Royal Army Medical Corps and the Medical Department of the United States Army was the separation of the area covered by preventive medicine as it existed in the American forces, into two divisions in the British Army, the Department of Pathology and the Department of Hygiene.

The Department of Pathology had to do among other things with immunization and with laboratory interests. The Department of Hygiene carried responsibility for essentially all activities in preventive medicine as interpreted in American practice, other than those named.

Thorough-going conferences and reviews of policies and experience were held by both these departments at about six month intervals. A representative of the American Division of Preventive Medicine was regularly included in the meetings of the advisory councils possessed by both organizations, not as an observer or visitor but with every expectation that he would constitute a part of the group, participate fully in discussions, be consulted in technical procedures, and evaluate practices. No finer collegial relationship could have developed.

In the detailed planning of joint operations naturally the British and American specialists in preventive medicine devoted much effort to coordination of governing policies and opinions.

The material help afforded the United States forces during the early months of the theater deserves special mention. Members of the American forces, both officers and enlisted men were received at the Army School of Hygiene at Aldershot for courses of instruction in field methods of sanitation, along with British colleagues. Technical help was furnished on many occasions by laboratories at Everleigh and the Army Medical School. Supplies and equipment so often lacking at that time were provided from British sources. This satisfactory relationship between the two services came in large part through the activities of the British liaison officer regularly assigned to the headquarters of the European Theater. He was accepted as a part of the American organization. The frequent opportunities for comparison of British and American experiences were made possible by the free access to British information and British opinion which came through the liaison officer.

The similarity in practices and in attitudes towards preventive medicine arising from the close cultural unity of the United States and its neighbor to the north gave a common understanding and a close coordination of interests between the Department of Hygiene of the Canadian Army and the Division of Preventive Medicine in the American forces. Among these was the control of the venereal diseases. As with the British, Canadian prophylactic stations were open to the soldiers of all allied forces.

The Red Army arranged for liaison with the United States forces in medical affairs, but no medical officer of the Russian Army was stationed regularly with the American forces. Periodic visits of a senior medical officer served to keep our Russian ally informed of the medical problems encountered by the American forces and the methods employed in their management.

Civilian Agencies of the United States.--An early visit to Great Britain in 1941 by Surgeon General Parran of the United States Public Health Service, served to establish a working arrangement between that agency and the United States military forces. Later the Public Health Service stationed an officer of its corps at the embassy in London, largely charged with integration of civilian interests in public health of the two

countries, but nevertheless frequently concerned with purely military affairs in preventive medicine. Technical opinion and advice from the National Institute of Health was drawn on freely in the conduct of military preventive medicine in the theater.

The Office for Scientific Research and Development maintained an office at the United States Embassy from 1941 until the end of hostilities. The organization was interested in all scientific objectives having a connection with the war effort. The files of that office were a fruitful source for the Division of Preventive Medicine in obtaining information necessary to the conduct of operations in Europe and sometimes impossible or difficult to obtain through military channels. In many instances, the Office instituted special inquiries through its facilities in the Zone of the Interior which gave information and opinions essential to solution of military problems. In turn, the Division of Preventive Medicine contributed information on events and circumstances which had a bearing on developmental projects close to the interests of the Office for Scientific Research and Development in America.

Many health measures having to do with members of the merchant marine were effected through cooperation with the War Shipping Administration office in London. The part this agency played in the development of satisfactory measures for the sanitary control of ports was material.

British Civilian Agencies.—Our own national health service was no closer nor more helpful in furthering the interests of the United States Army than was the British Ministry of Health. The association of the army preventive medicine personnel with this agency antedated the outbreak of war, for prior to that event the subsequent Chief of the Preventive Medicine Division served with the Ministry of Health as liaison officer with American public health authorities. When the United States entered the war and the American liaison officer was transferred to the Army, the same professional relationship continued. The confidential reports of the Ministry on health conditions in Britain were regularly supplied to the Division of Preventive Medicine. Statistical information on the incidence of disease came weekly from all major jurisdictions of the United Kingdom. When the United States Army lacked laboratory facilities in the early days of the war, the full facilities of the Emergency Public Health Laboratory Service of the Ministry were made available. Specialized help in laboratory procedures

was always provided in handling problems which extended beyond the facilities of an army in the field. Many epidemiologic investigations involving the civilian population and the U. S. Army were joint undertakings.

No common interest outweighed in importance the venereal diseases. Support was obtained from the Ministry in the development of a program of control which made extensive use of epidemiologic methods through case finding. The co-operation that arose from local health authorities was in large measure due to the good auspices of the Ministry.

Indeed, few problems in public health failed to touch the common interest of the U. S. Army and the Ministry of Health. The facility with which they were satisfactorily settled was due in no small degree to the fact that the Chief of Preventive Medicine was included as a regular member of the staff council of the Ministry, whose weekly meetings provided excellent opportunity for exchange of information, settlement of difficulties, and mutually determined action.

Numerous British scientific institutions had a part in furthering work in preventive medicine in the United States Army. The Medical Research Council, through its National Institute for Medical Research laboratory at Hampstead gave long collaboration to the Eighth Air Force in experimental tests of aerosols for the control of respiratory disease. The facilities of one of the outstanding laboratories of the world were available to the U. S. Army Medical Department in problems associated with influenza. The activities of the London School of Hygiene were largely suspended during the war but the aid of its faculty was freely furnished in regard to problems associated with louse control, management of scabies, housing and ventilation, and a variety of other fields.

Civilian Health Agencies in France.---The French Ministere de la Sante Publique was one of the first governmental agencies with which contact was established by the Preventive Medicine Division when Paris was entered by the United States forces. In accordance with the precedent set in Great Britain, the Division was made the liaison between the Ministry and the Medical Department. Little actual information was at hand on the health conditions of the city or of the nation. The rapid sanitary survey made of Paris and the surrounding territory at that time was possible through the energetic collaboration of the French authorities, themselves just returning to their posts and

undertaking the reorganization of facilities after the German occupation. The reporting of the communicable diseases was fragmentary at the time but such information as the Ministry possessed was promptly placed at the disposal of the Preventive Medicine Division of the American Army.

The venereal diseases were a prominent interest of both the Army and the Ministry. The plans which were made, the support which the Ministry of Health solicited from the French police, and the cooperation obtained from local health authorities did much to produce the satisfactory rates for these diseases experienced by the United States Army, and in the end led to appreciable improvement in the control of prostitution in France, an objective which had long been sought by forward looking French health authorities. The Office Internationale d'Hygiene Publique promptly put in the hands of United States military health authorities reports of that office on sanitary conditions of ports and the movement of the quarantinable diseases in the European area.

The Institut Pasteur housed the central laboratory of the United States Army for many months. It provided anti-rabic vaccine and other biologic products for the use of the Army. Most valuable of all were the consultation and advice given by the staff of this famous research institute. The Institut Arnold Fournier occupied a similar position in respect to problems associated with syphilis and the other venereal diseases.

Belgian Civil Health Authorities.--The number of United States troops stationed in Belgium was relatively small but the community of interests in health affairs between the local officials and the army was no less close than in other countries where American soldiers were stationed. A new venereal disease law came into being as a result of common endeavor by civilian and Army health workers. Particular mention is made of the fact that the first use of penicillin as a measure for eliminating foci of infection of the venereal diseases was in Liege. A center was established for the treatment of infected prostitutes by the Health Department of the city, was supplied with the necessary drug through American help, and supervision and field work was contributed by public health nurses of the Army. This pioneer effort led to the development of a system which later received large scale application in occupied cities of Germany.

American Red Cross.--Much emphasis has been placed in preceding discussions on the first of the stated objectives of the preventive medicine service, which was the maintenance of health. The efforts extended in military occupational hygiene were largely devoted to accomplishing the second aim, the physical well-being of the soldier. The service in preventive medicine had an intimate concern with the work of the American Red Cross as it affected the third function, the morale of the Army. The obligations of a number of military organizations were related to the morale factor, the Special Services Group, the Corps of Chaplains and others; and working with the Army to that end were civilian organizations such as the United Services Organization and the American Red Cross. (Figure 5) The Red Cross hostels were the home of the soldier on pass or furlough; the clubs were his place of relaxation after duty hours.

The Medical Department consequently had a deep interest in helping toward achievement of the ends for which the Red Cross organization in the theater was established. The preventive medicine service had the obligation of assuring that the sanitary facilities and the provisions for maintenance of health in Red Cross installations were equivalent to those provided by the Army.

Primarily for this reason the Army assigned an officer of the Medical Corps as a liaison health officer to work with the Red Cross in furthering the joint interests of that organization and of the Army. The liaison officer took up his duties in March 1943 under an arrangement which continued throughout the period of principal activities in Britain and until the main body of troops left for the continent in 1944.

A secure system of sanitary inspection and control of housing facilities in clubs and hostels was early developed under his direction. Messing arrangements, general sanitation of premises, control of food handlers and the manifold interests of Army housekeeping entered into the program. To further this work, the Army assigned a group of eight public health nurses who served Red Cross headquarters for several months during the early development of activities. As the details of essential sanitary procedures became apparent, a sanitary order to govern Red Cross institutions was prepared by the liaison health officer with the help of the nurses who had made most of the sanitary inspections, and this was adopted by the American Red Cross as standard operating procedure.

Great credit accrues to the American Red Cross for the serious effort made to bring sanitary conditions in Red Cross clubs to a standard approximating that of the Army. It was one



Figure 5

The American Red Cross at a rest camp for combat troops,
Belgium, October 1944.

thing to accomplish that end under military conditions, with the favorable situations of discipline, supplies and trained personnel; and wholly another to attempt the same standards with untrained civilian staffs, drawn largely from another nation.

Cooperative effort in the control of the venereal diseases between the American Red Cross and the Army deserves special mention. Conditions in Great Britain limited the usefulness of the usual system of station prophylaxis. Prophylactic stations could not be found in the blackout. The wide dispersal of troops acted against ready availability. The American Red Cross clubs were where the troops lived while on pass or furlough. They were continuously the center of social activities. Everyone knew where they were. The ready agreement of the overseas organization of the American Red Cross to permit installation of prophylactic stations in their clubs was both broad-minded and indicative of the present day realistic attitude toward these conditions, which basically looks upon them as just part of a number of communicable diseases susceptible to the same fundamental measures used for communicable disease control in general.

Professional Education in Preventive Medicine.--Under military conditions, the part of preventive medicine in general medical practice was so much greater and received so much more emphasis than is ordinary, that courses of instruction in military medicine gave unusual consideration to this subject. The American School Center was established at Shrivenham, England in March 1943 as a general army school, but a goodly part of its activities were medical. A course of one month in field methods of medical practice was repeated regularly during the period of training for operations in France. When operations became a reality the school was transferred to the Continent and resumed activities at Etampes, near Paris.

The course of instruction included full consideration of the control of the communicable diseases, of water supply, environmental sanitation, nutrition, venereal disease control and the control of insects. Members of the theater Division of Preventive Medicine augmented the regular teaching staff of the school and practical instruction in sanitation was furthered by a demonstration sanitary area designed and built by members of the Sanitation Branch of the Office of the Chief Surgeon.

The need for instruction in special laboratory disciplines and for the training of laboratory technicians led to establishment of a training school for officers and enlisted men at the First Medical General Laboratory.

The British Post-Graduate Medical School gave a series of courses in war medicine throughout the war years, participated in by many officers of the Canadian and American armies, as well as those of the Royal Army Medical Corps for whom it was primarily intended. A number of the senior officers of the United States Army medical corps, including members of the Division of Preventive Medicine served on the faculty. The course of instruction was sponsored by the War Office of Great Britain.

Specialized and intensive instruction in military hygiene was provided by the British Army School of Hygiene at Aldershot, through which many officers and men of the United States Army had the advantage of contact with British ideas and British procedures.

Committees.---Both in France and in Great Britain, medical officers of the United States Army participated in the work of many committees that dealt with a variety of medical subjects, mostly related to the war effort but not invariably so, for physicians generally entered intimately into the medical life of the country in which they were living. Among these bodies were a Joint Committee on the Control of Venereal Diseases and a Committee on Social Implications of the Venereal Diseases. The first committee was organized by the British Ministry of Health to develop procedures for coordinated effort between civilian health authorities and those of all services, British, American and Canadian, to the end of facilitating improved conditions in relation to both civil and military populations. The Committee on Social Implications of the Venereal Diseases was organized by the British Social Hygiene Council and was primarily concerned with civilian interests on a long term basis. The Jaundice Committee of the Medical Research Council included representatives of the United States Army. The special investigations conducted under the auspices of this group led to material contributions in this developing field.

Other special groups were concerned with problems of water supply, louse control, typhus fever, tuberculosis and other interests sufficiently numerous to include the major fields of preventive medicine.

A Committee on Social and Preventive Medicine, of which the Chief of the Preventive Medicine Division was a member, was formed in 1942 by the Royal College of Physicians. The Committee was one of the first groups to emerge in the field of post war planning. Its deliberations extended over three years and led to clarification of the objectives and aims of preventive medicine in present day practice. A method of presentation to future medical students was defined. The work of the committee was illustrative of the possibility of maintaining interest in fundamental problems of medicine under war conditions and of the community of interests of physicians irrespective of nationality and individual concern.

FIGURES

1. Construction of a sewer line by the Engineer Corps, Wilton, England, 1943.
2. DDT powder for the prevention of the spread of typhus, 345th Quartermaster Depot Company, Herbesthal, Belgium, December, 1944.
3. The military police and gendarmes patrol the streets of Cherbourg, France, July 1944.
4. An Allied Civil Affairs unit, Verdun, France, September 1944.
5. The American Red Cross at a rest camp for combat troops, Belgium, October 1944.

A HISTORY OF PREVENTIVE MEDICINE
IN THE
EUROPEAN THEATER OF OPERATIONS
UNITED STATES ARMY
1941 - 1945

PART XII - The Health of the Command

by

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PART XII - The Health of the Command

Throughout the many weeks of operations in Europe, and from a variety of headquarters, the Chief of the Division of Preventive Medicine was accustomed to submit to the Chief Surgeon of the Theater a review of the principal events of the week in Preventive Medicine, epidemiologic notes, and a tabulated summary of cases and deaths from disease, non-battle injury, and battle casualties. The statistical summary that concluded the report was designed to give the factual data upon which opinion was based as to the health of the command. The same procedure would seem a fitting way to conclude this more pretentious history of the events that took place during the whole time that the United States Army functioned in Europe as the European Theater of Operations. (Figures 1 - 7).

Monthly Admissions for the Theater as a Whole.--Both admissions to hospital and to quarters are included in these data which are derived from the weekly Statistical Health Reports.

All Diseases.--The conditions classified as disease were the commonest cause of admission to hospital or quarters, with an average admission rate for the whole period of operations of 546 per thousand strength per year. The best year was 1944 although the six month period of 1945 was almost as good. The highest average annual rate for any year, that of 837 in 1943, was largely due to increased rates for respiratory disease. In all years, the monthly distribution of admissions reflects the same influence. Table 1.

In the course of the discussion devoted to epidemiology full attention has been given to the principal causes of admission to sick report as a result of infectious diseases. That information will not be reviewed. Other than infectious diseases, admissions because of neuropsychiatric disturbances were a strong contributing factor to the total disease admission rates. The data are presented in Table 2.

Non-battle Injuries.--The average rate for the period of operations was 105 per 1000 strength per year and no great variation occurred from year to year. The rates for 1945 were greatest, 115 per thousand, as would be anticipated for the period of most active operations; but even in that year the rates did not greatly exceed the established average. No characteristic monthly distributions were evident, but the outspoken influence of field operations and of intensified training are well demonstrated. Table 3.

Battle Casualties.--The first battle casualties of the European Theater recorded on Medical Statistics Reports were in August 1942 when 13 patients were included in the records of the theater, for a rate of 2 per thousand per annum. With increasing military activities the rates rose in regular progression until March 1943, when they reached a level of 35. Thereafter the frequency of admissions from this cause was established at about 6 per thousand per year until the great Normandy invasion in June 1944.

The early months of that campaign were naturally associated with high losses and the greatest rates for battle casualties of the period of operations came in July, with 326 per thousand per year. Thereafter the rates were not much in excess of 200. An appreciable rise occurred in the November offensive of 1944, but the rates tapered off as the campaign moved to an end in the spring of 1945. Some few admissions from this cause still occurred after the cessation of hostilities in early May.

Admissions for All Causes.--The admissions to hospital and quarters for all causes are presented in Table 5, a summary of the three principal categories presented above. The overall rate was 775 and the total number of admissions 2,466,196.

Monthly Admissions - Operations in Continental Europe.--From all considerations, medical and military, the period of operations on the continent was of greatest interest. For reasons that have been brought out, complete data from the landing in Normandy on 6 June 1944 until operations ceased on 8 May 1945 are not now available. Information is at hand for the period September 1944 to June 1945 inclusive.

Disease, All Forms.--Admissions for disease of all forms were somewhat more frequent on the continent than for troops stationed in Britain, but the difference was not great; the rate for the period on an annual basis being 461 for troops in Great Britain and 533 for those on the continent. Table 6. The evacuation policy influenced the distributions greatly, for in the early months a great proportion of patients were returned to the United Kingdom, while later those less seriously affected and patients requiring no more than care in quarters were held on the continent.

Neuropsychiatric Conditions.--The data for neuropsychiatric disturbances fails also to show the true state of affairs in distributions between the two areas, because of many admissions to hospital in Great Britain representing troops returned from the continent. Table 7.



Figure 1

The maintenance of health is a function of command. General Dwight D. Eisenhower, Supreme Allied Commander, examines the field jacket of a soldier at the 16th Reinforcement Depot, February 1945.



Figure 2

Medical care of the sick and wounded is the first obligation of the Medical Corps. The 45th Field Hospital at Weissensee, Germany, April 1945.



Figure 3

Good hospital care decreases non-effectiveness. A patient with a lung wound in the shock ward of an Evacuation Hospital, France, July 1944.



Figure 4

The prevention of disease limits hospital admission. Drinking water is tested for its chlorine residual, 26th Infantry Division, Luxembourg sector, January 1945.



Figure 5

Medicine is many sided. Dental care in the
26th Infantry Division, Germany, February 1945.



Figure 6

The protection of the food supply is fundamental to prevention of disease. Inspection of frozen poultry by an army veterinarian at a cold storage plant in Paris, February, 1945.



Figure 7

Precision furthers accomplishment. Laboratory service at the 5th General Hospital, Northern Ireland, November 1942.

Non-battle Injuries.--The frequency of non-battle injuries among troops remaining in Great Britain was less than for the period immediately preceding extension of theater activities to the continent, largely because active training operations were absent. The rates on the continent were not greater by any appreciable degree than during the period of preparation and training. Table 8.

Battle Casualties in Great Britain.--The rates for battle casualties for the two locations again reflect the evacuation policy in the early months. Thereafter the rates for Great Britain are essentially those of the 8th Air Force which continued to operate from that base. Table 9.

All Causes.--The summary of all causes of admission by months for the available period of operations in respect to both Great Britain and the continent, is given in Table 10.

Deaths.--The deaths that occurred among troops of the European Theater during the four years covered by operations are presented in Table 11. Of the three major categories by cause, battle casualties were responsible for the greatest number, with non-battle injury next and disease giving rise to the least number. The ratio between deaths due to disease and those due to battle casualties was 83 to 1, which provides an interesting comparison with the same ratio which existed in relation to American troops serving in Europe in the preceding war. The established ratio then was 3 to 1. Figure 8.

Deaths from infectious disease bear a particularly close relation to interests in Preventive Medicine. The experience of the theater is summarized in Table 12. Pneumonia, with 141 deaths, causes the greatest number of fatalities, 109 of these were primary cases and 32 secondary infections. Meningitis caused a total of 101 deaths, 99 resulting from meningococcus meningitis and 2 from meningococcus septicemia. Infectious hepatitis caused 68 deaths, 44 resulting in 1945. There were 53 deaths from tuberculosis, 34 from diphtheria and 15 from gas gangrene. The remaining infectious processes were represented by only a few scattered fatal cases.

Non-effective Rates.--The non-effective rates for the entire strength of the theater and for the period dating from February 1942 to June 1945 are shown in Table 13, Figure 9. No significant variations are to be noted during the many months that preceded the campaign in Europe. With that event, the non-effective rates evidenced material increases, with a high point in January 1945. The influence of the undue prevalence of trench foot at this time is strongly marked. With the cessation of hostilities non-effective rates returned to the level established in the course of many months of operations in Europe.

Data are available for the distribution of non-effectiveness in relation to the three principal causes, those of disease, non-battle injury, and battle casualties, for the period from January 1944 until the activities of the theater ceased. They are illustrated in Table 14, Figure 10, where it is evident that battle casualties and disease were the principal contributing influence, with a relatively minor influence contributed by non-battle injuries.

Comparison with Other Theaters.--The admission rates for all diseases showed great variation among the several theaters of operation, with the greatest frequency reported from the Africa-Middle East Theater and the best rate from the North American area. The European Theater ranked second in relative frequency among theaters with a rate that was better than that for troops stationed in continental United States by an appreciable margin. Table 15.

The record of the European Theater was likewise good in the matter of non-battle injuries, with a relative standing of fourth among Theaters of Operation. The highest rate was that of the Alaskan Theater, 152 per thousand per year, and the best showing came from the South American Theater where the frequency was 93 per thousand per year. The differences between the various theaters were less marked than in respect to disease, because the contributing factors were more nearly the same than in respect to infectious and other disease processes. Table 16.

The admission rates for battle wounded were far greater in the European Theater than in any other, with an average for the period of operations of 124 per thousand per year. The Mediterranean Area was next with a rate of 97. The Southwest Pacific had a rate of 54, closely followed by the Pacific Ocean Area with 40. Other theaters, including the China-Burma-India Theater were relatively free from heavy combat, and admissions from this cause were few. Table 17.

The summation of admissions for all causes to hospital and quarters led to formidable figures. Table 18. The rates for all causes were greatest in the Southwest Pacific Theater, with the Mediterranean, the Africa-Middle East area and the China-Burma-India Theater all grouped closely thereafter. The European Theater stood fifth despite the greatest number of admissions from battle wounded. The remaining four theaters were again grouped at a general level within the range of about 750 cases per thousand strength per year. The best health record for any expeditionary force was attained by the North American Theater where the rate was 659.

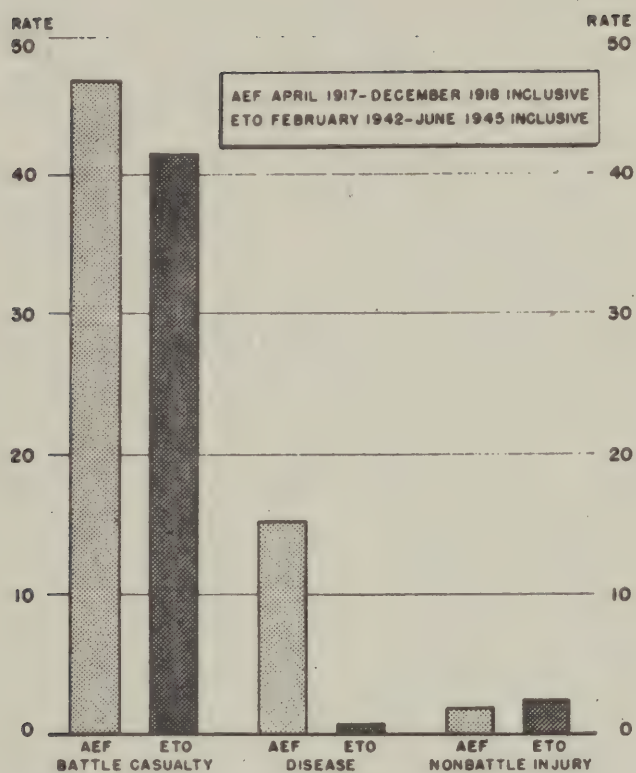


Figure 8.

Causes of death in World Wars I and II, troops of the AEF and of the European Theater of Operations, U.S. Army, average rates per 1000 strength per annum.

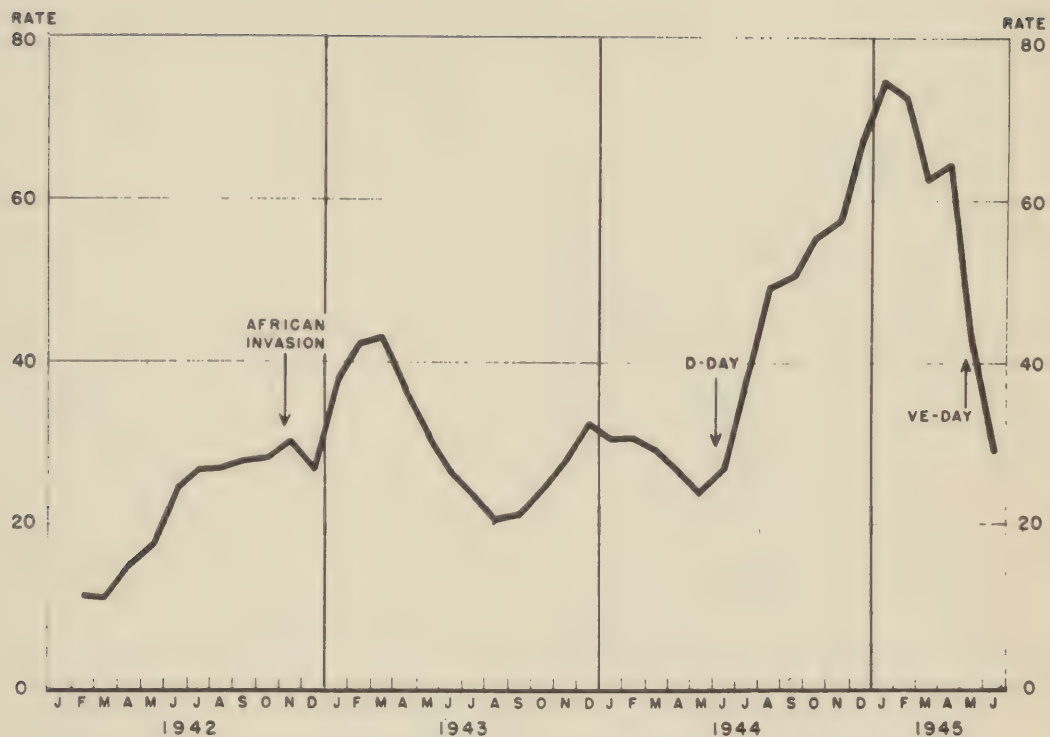


Figure 9

Average daily non effective rates per 1000 strength, European Theater of Operations, U.S. Army, by months, February 1942 to June 1945 inclusive.

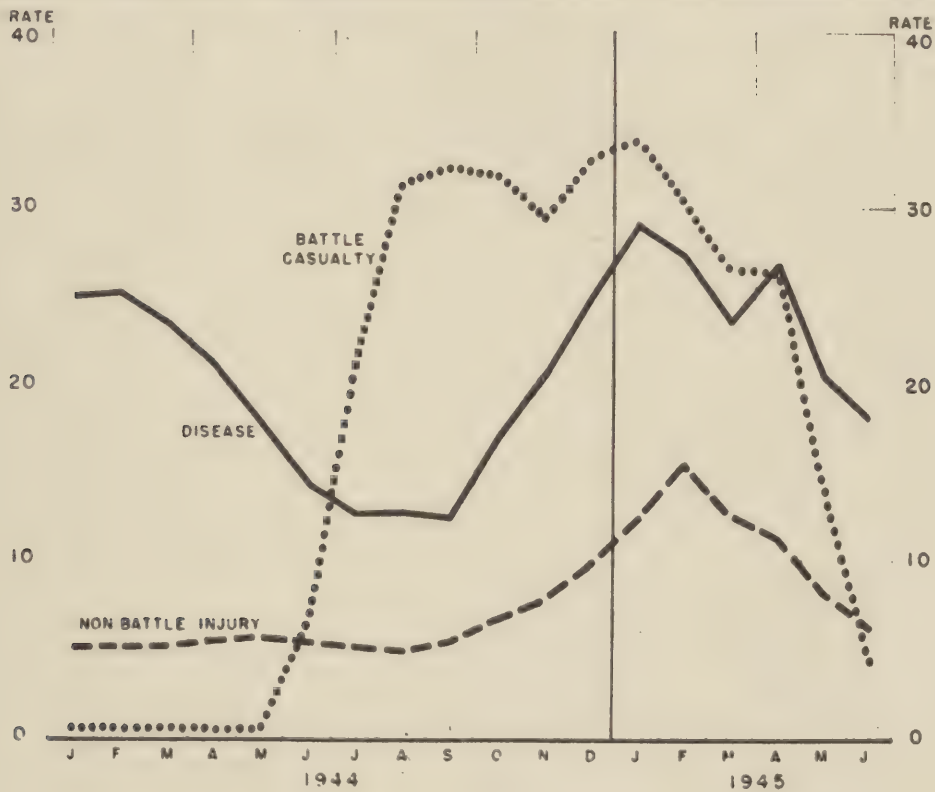


Figure 10

Average daily non-effective rates per 1000 strength, disease non-battle injury and battle casualty, European Theater of Operations U.S. Army, January 1944 to June 1945, inclusive.

Table 1

Admissions to Hospitals and Quarters, All Diseases
 European Theater of Operations, U. S. Army
 Cases and Rates per thousand strength per annum, by months
 February 1942 to June 1945 inclusive

Month	Total		1942		1943		1944		1945	
	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate
Jan.	181742	677			13837	1264	49440	805	118465	605
Feb.	181695	637	334	1083	9487	1122	53012	754	118862	577
Mar.	223232	592	527	667	8510	1027	73994	717	140201	530
Apr.	165141	511	546	623	7987	755	54067	482	102541	469
May	170990	512	1257	590	6133	650	45970	458	117630	531
June	193891	477	1840	518	7115	586	44768	352	140168	532
July	50778	378	3392	530	9637	504	37749	347		
Aug.	55751	360	4707	536	9363	484	41681	329		
Sep.	69684	349	7288	576	12536	537	49860	305		
Oct.	99860	519	11758	703	23118	631	64984	467		
Nov.	139762	683	10301	924	47347	1156	82114	538		
Dec.	202737	674	8931	957	66008	1015	127798	564		
Total	1735263	546	50881	700	221078	837	725437	492	737867	538

Source: Medical Statistics Division, Office of the Surgeon General
 War Department, Washington, D.C.

Table 2

Admissions for Neuro-Psychiatric
Conditions, Hospital and Quarters,
European Theater of Operations, U. S. Army
Cases and Rates per 1000 strength
per annum, by months
July 1942 to June 1945
inclusive

Month	Total		1942		1943		1944		1945	
	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate
Jan.	12298	46			141	13	2228	36	9929	51
Feb.	9340	33			119	14	1766	25	7455	36
Mar.	12339	33			154	19	1935	19	10250	39
Apr.	8506	26			123	12	1653	18	6730	31
May	5549	17			262	28	1990	20	3297	15
June	7342	18			226	19	3679	29	3437	13
July	9567	71	28	4	306	16	9233	85		
Aug.	10046	65	69	8	379	20	9598	76		
Sep.	7106	36	23	2	537	23	6546	40		
Oct.	9800	51	57	3	644	18	9099	65		
Nov.	13803	67	82	7	782	19	12939	85		
Dec.	18123	60	37	4	1860	29	16226	72		
Total	123819	39	296	4	5533	21	76892	52.2	41098	30

Source: Medical Statistics Division, Office of the Surgeon General
War Department, Washington, D. C.

Table 3

Admissions to Hospitals and Quarters, Non-battle Injuries
 European Theater of Operations, U. S. Army
 Cases and Rates per 1000 strength per annum, by months
 February 1942 to June 1945 inclusive

Month	Total		1942		1943		1944		1945	
	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate
January	40841	152			1710	156	4968	81	34163	174
February	30693	108	50	162	1286	152	5868	83	23489	114
March	38383	102	43	54	1305	157	9395	91	27640	104
April	34069	105	54	61	1213	115	8085	87	24717	113
May	35074	105	121	57	1042	110	9092	90	24819	112
June	34285	84	316	89	1246	103	9827	77	22896	87
July	16362	122	647	101	1939	101	13776	126		
August	14018	90	964	110	1854	96	11200	88		
September	15675	79	1538	121	2206	94	11931	73		
October	17721	92	2025	121	3577	98	12119	87		
November	21083	103	1237	111	3722	91	16124	106		
December	37241	124	1028	110	5397	83	30816	136		
Total	335445	105	8023	110	26497	100	143201	97	157724	115

Source: Medical Statistics Division, Office of the Surgeon General
 War Department, Washington, D. C.

Table 4

Admissions to Hospital and Quarters, Battle Casualties
 European Theater of Operations, U. S. Army
 Cases and Rates per 1000 strength per annum, by months
 August 1942 to June 1945 Inclusive

Month	Total		1942		1943		1944		1945	
	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate
Jan.	42830	160	*		225	21	232	4	42373	216
Feb.	27141	95	*		204	24	456	7	26481	129
Mar.	50508	134	*		293	35	431	4	49784	188
Apr.	34631	107	*		34	3	501	5	34096	156
May	5312	16	*		81	9	418	4	4813	22
June	28204	69	*		109	9	27675	218	420	2
July	35656	265	*		156	8	35500	326		
Aug.	26949	174	13	2	136	7	26800	211		
Sep.	33338	167	21	2	117	5	33200	203		
Oct.	19551	102	23	1	228	6	19300	139		
Nov.	42711	209	58	5	253	6	42400	278		
Dec.	48657	162	51	6	406	6	48200	213		
Total	395488	124	166	2	2242	9	235113	160	157967	115

* Data not available.

Source: Medical Statistics Division, Office of the Surgeon General
 War Department, Washington, D. C.

Table 5

Admissions to Hospitals and Quarters, All Causes

European Theater of Operations, U. S. Army

Cases and Rates per 1000 Strength per Annum

February 1942 to June 1945, Inclusive

Cause	Total		1942		1943		1944		1945	
	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate
Disease	1,735,263	546	50,881	700	221,078	837	725,437	492	737,867	538
Non-battle Injury	335,445	105	8,023	110	26,497	100	143,201	97	157,724	115
Battle Casualties	395,488	124	166	2	2,242	9	235,113	160	157,967	115
Total	2,466,196	775	59,070	812	249,817	946	1,103,751	749	1,053,558	768

Source: Medical Statistics Division, Office of the Surgeon General, War Department,
Washington, D. C.

Table 6

Admissions to Hospitals and Quarters, All Diseases
 Continental Europe and United Kingdom,
 European Theater of Operations, U. S. Army
 Cases and Rates per 1000 strength per annum, by months
 September 1944 to June 1945 Inclusive.

Month	Total		United Kingdom		Continent	
	Cases	Rate	Cases	Rate	Cases	Rate
1944						
Sep.	49860	305	26415	400	23445	240
Oct.	64984	467	19563	470	45421	466
Nov.	82114	538	19513	476	62601	562
Dec.	127798	564	27652	460	100146	601
1945						
Jan.	118465	605	25861	525	92604	631
Feb.	118862	577	21084	446	97778	616
Mar.	140201	530	23151	458	117050	547
Apr.	102541	469	17177	444	85364	474
May	117630	531	15146	507	102484	535
June	140168	532	*		*	
Total	1062623	518	195562**	461	726893**	533

* No data available.

** June not included.

Source: Medical Statistics Division, Office of the Surgeon
 General, War Department, Washington, D. C.

Table 7
Admissions to Hospitals and Quarters,
Neuropsychiatric Diseases, Continental Europe and United Kingdom,
European Theater of Operations, U. S. Army,
Cases and Rates per 1000 strength per annum, by months,
September 1944 to June 1945, inclusive

Month	Total		United Kingdom		Continental Europe	
	Cases	Rate	Cases	Rate	Cases	Rate
1944 September	6546	40	3387	51	3159	32
October	9099	65	3554	85	5545	57
November	12939	85	4736	115	8203	74
December	16226	72	5006	83	11220	67
1945 January	9929	51	2075	42	7854	54
February	7455	36	492	10	6963	44
March	10250	39	560	11	9690	45
April	6730	31	462	12	6268	35
May	3297	15	478	16	2819	15
June	3437	13	546	12	2891	13
Total	85908	42	21296	45	64612	41

Source: Medical Statistics Division, Office of The Surgeon General, War Department, Washington, D. C.

Table 8

Admissions to Hospitals and Quarters,
Non-battle Injuries, Continental Europe and United Kingdom,
European Theater of Operations, U. S. Army,
Cases and Rates per 1000 Strength, by Months,
September 1944 to June 1945, Inclusive

Month	Total		United Kingdom		Continental Europe	
	Cases	Rate	Cases	Rate	Cases	Rate
1944 September	11931	73	4520	68	7411	76
October	12119	87	3250	78	8869	91
November	16124	106	3055	75	13069	117
December	30816	136	3698	62	27118	163
1945 January	34163	174	4933	100	29230	199
February	23489	114	2336	49	21153	133
March	27640	104	2620	52	25020	117
April	24717	113	2303	59	22414	124
May	24819	112	1764	59	23055	120
June	22896	87	*	*	*	
Total	228714	111	28479**	67	177339**	130

* No data available.

** June not included.

Source: Medical Statistics Division, Office of The Surgeon General,
War Department, Washington, D. C.

Table 9

Admissions to Hospitals and Quarters, Battle Casualties,

Continental Europe and United Kingdom

European Theater of Operations, U. S. Army,

Cases and Rates per 1000 Strength per annum, by months,

September 1944 to June 1945, Inclusive

Month	Total		United Kingdom		Continental Europe	
	Cases	Rate	Cases	Rate	Cases	Rate
1944 September	33200	203	15388	233	17812	183
October	19300	139	3668	88	15632	160
November	42400	278	11425	279	30975	278
December	48200	213	46	1	48154	289
1945 January	42373	216	1391	28	40982	279
February	26481	129	433	9	26048	164
March	49784	188	395	8	49389	231
April	34096	156	555	14	33541	186
May	4813	22	23	1	4790	25
June	420	2	*		*	
Total	301067	147	33324**	78**	267323**	196**

Source: Medical Statistics Division, Office of The Surgeon General, War Department, Washington, D. C.

*Data not available.

**June not included.

Table 10

Admissions to Hospitals and Quarters, All Causes,

Continental Europe and United Kingdom,

European Theater of Operations, U. S. Army,

Cases and Rates per 1000 Strength, per annum, by months,

September 1944 to June 1945, Inclusive

Month	Total		United Kingdom		Continental Europe	
	Cases	Rate	Cases	Rate	Cases	Rate
1944 September	94991	581	46323	701	48668	499
October	96403	693	26481	636	69922	717
November	140638	922	33993	830	106645	957
December	206814	913	31396	523	175418	1053
1945 January	195001	995	32185	653	162816	1109
February	168832	820	23853	504	144979	913
March	217625	822	26166	518	191459	895
April	161354	738	20035	517	141319	784
May	147262	665	16933	567	130329	680
June	163484	621	*		*	
Total	1592404	776	257365**	606**	1171555**	859**

*No data available.

**June not included.

Source: Medical Statistics Division, Office of The Surgeon General,
War Department, Washington, D. C.

Table 11

Deaths from all Causes
European Theater of Operations - U. S. Army
With Rates per 1000 Strength per annum, by Years,
February 1942 to June 1945, Inclusive

Causes	Total		1942		1943		1944		1945	
	Deaths	Rate	Deaths	Rate	Deaths	Rate	Deaths	Rate	Deaths	Rate
Disease*	1594	.5	36	.5	111	.4	590	.4	857	.6
Non-battle Injuries*	9085	2.9	199	2.7	768	2.9	3900	2.6	4218	3.1
Died of Wounds**	16251	5.1	25	.3	65	.2	10781	7.3	5380	3.9
Killed in Action**	107258	33.7	147	2.0	2799	10.6	38856	46.7	35456	25.9
Declared and Reported Dead While Missing in Action	9012	2.8	134	1.8	2162	8.2	5363	3.6	1353	1.0
Died While Prisoners or Internees***	895	.3	7	.1	44	.2	603	.4	241	.2
Total	144095	45.3	548	7.5	5949	22.5	90093	61.0	47505	34.7

Source: Medical Statistics Division, Office of The Surgeon General, War Department, Washington, D.C.

* - Figures for 1942 and 1943 based on Individual Medical Records; for 1944 and 1945, on the Statistical Health Report (WD AGO Form 8-122, formerly WDMD Form 86ab).

** - Data taken from "Battle Casualties of the Army," 1 July 1946, prepared for WDGS by Machine Records Branch, Office of The Adjutant General.

*** - Does not include 190 persons who died of wounds while prisoners of war or internees. These deaths are included in "Died of Wounds" above.

Table 12
Deaths from Infectious Diseases,
European Theater of Operations, U. S. Army
Number by Diagnosis and Years,
February 1942 to June 1945, Inclusive

Infectious Diseases	Total	1942	1943	1944	1945
Common respiratory	6			1	5
Pneumonia, primary	64		2	30	32
Pneumonia, primary atypical	45	1	3	8	33
Pneumonia, secondary	32	1	2	6	23
Influenza	1		1		
Meningitis, meningococcal	99	6	13	40	40
Meningococcal infection, other	2		2		
Scarlet fever	4			2	2
Streptococcal sore throat	1			1	
Rheumatic fever	3			2	1
Diphtheria	34			5	29
Poliomyelitis	8		1	4	3
Chickenpox	1			1	
German measles	1			1	
Mumps	2				2
Tuberculosis	53	2	5	20	26
Encephalitis	3			3	
Malaria	6			4	2
Fever of undetermined origin	1				1
Hepatitis, infectious	68		2	22	44
Weil's disease	1			1	
Common diarrhea	3		1		2
Dysentery, amoebic	1				1
Dysentery, bacillary	1				1
Syphilis	2		1	1	
Tetanus	1			1	
Gas gangrene	15			6	9
Mycotic Dermatoses	1				1
Total	459	10	33	159	257

Source: Medical Statistics Division, Office of The Surgeon General,
War Department, Washington, D. C.

Table 13

Average Daily Non-effective Rates per 1000 Strength

European Theater of Operations, U. S. Army,

By Months, February 1942 to June 1945, Inclusive

Month	1942	1943	1944	1945
January		37.7	30.3	75.3
February	11.1	42.4	30.5	72.8
March	10.9	43.1	29.4	62.3
April	14.6	36.6	26.8	64.4
May	17.4	30.6	23.6	42.9
June	24.0	26.3	26.6	28.8
July	26.0	23.7	39.4	
August	26.5	20.4	49.2	
September	27.4	21.8	50.5	
October	27.7	24.0	55.4	
November	30.1	27.3	57.7	
December	26.1	32.2	67.7	
Total	26.6	29.1	44.6	56.5
Total 1942 - 1945		48.1		

Source: Medical Statistics Division, Office of
The Surgeon General, War Department,
Washington, D. C.

Table 14

Average Daily Non-effective Rates per 1000 Strength,
For Disease, Non-battle Injury and Battle Casualty,
European Theater of Operations, U. S. Army,
January 1944 to June 1945, Inclusive

Month	Disease	Non-battle Injury	Battle Casualty
1944 January	24.9	5.4	.4
February	25.1	5.0	.4
March	23.9	5.1	.4
April	21.1	5.2	.4
May	17.7	5.5	.4
June	14.4	5.4	6.8
July	12.8	5.1	21.5
August	12.8	5.0	31.4
September	12.6	5.5	32.4
October	16.8	6.7	31.9
November	20.4	7.7	29.6
December	25.1	9.7	32.9
1945 January	29.1	12.3	33.9
February	27.3	15.4	30.1
March	23.4	12.5	26.4
April	26.9	11.2	26.3
May	20.5	8.1	14.3
June	18.2	6.2	4.4
Total	21.3	8.5	20.7

Source: Medical Statistics Division, Office of The Surgeon
General, War Department, Washington, D. C.

Table 15

Admissions to Hospitals and Quarters, All Diseases,
Total Army, Continental United States and Theaters of Operations, U. S. Army,

Cases and Rates per 1000 Strength per annum, by years,
January 1942 to June 1945, Inclusive

Theater	Total		1942		1943		1944		1945	
	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate
Total Army	14120214	567	2047606	671	5163780	768	4550658	606	2358190	608
Total Overseas	5541949	690	348472	679	1370172	860	2288858	654	1534447	631
North America	90663	534	27248	672	39285	548	18226	433	5904	382
Europe	1735253	546	50381	700	221078	837	725437	492	737867	558
Alaska	155041	571	33564	668	71515	624	39766	478	10096	431
Pacific Ocean Area	626954	300	72312	494	239851	813	221457	561	92834	448
Continental United States	9578265	353	1699134	669	3793588	739	2261800	564	823743	571
Latin America	235832	376	84364	825	82748	684	46448	540	21772	558
Mediterranean	1148934	849	9618	451	406619	943	558051	846	174646	726
Southwest Pacific	1117120	926	55751	832	204267	1046	465289	840	391213	1006
China-Burma-India	308806	929	5951	1046	45636	991	171716	1077	85503	707
Africa-Middle East	123336	946	7783	1356	59073	1107	42468	896	14012	587

Source: Medical Statistics Division, Office of The Surgeon General, War Department, Washington, D. C.

Table 16

Admissions to Hospitals and Quarters, Non-battle Injuries
Total Army, Continental United States, and Theaters of Operations, U. S. Army,

Cases and Rates per 1000 Strength, per annum, by years,

January 1942 to June 1945, Inclusive

Theater	Total		1942		1943		1944		1945	
	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate
Total Army	1921342	91	294288	96	624849	93	666209	89	535996	87
Total Overseas	934179	116	63922	126	212194	133	395673	113	262390	108
Continental United States	987163	75	230366	91	412655	80	270536	67	73606	51
Latin America	32308	93	11180	109	12754	105	5995	70	2379	61
China-Burma-India	31541	95	460	81	3893	84	15385	96	11803	98
European	335445	105	8023	110	26497	100	143201	97	157724	115
Pacific Ocean Area	111366	107	15379	104	33590	114	43648	111	18749	90
Africa-Middle East	14679	113	928	162	7469	140	4712	99	1570	66
North America	21160	125	6330	156	9747	136	4065	96	1018	66
Mediterranean	179581	133	2040	96	64075	149	91063	138	22403	93
Southwest Pacific	166758	138	11963	178	33317	171	77046	139	44432	114
Alaska	41341	152	7619	152	20852	182	10558	127	2312	99

Source: Medical Statistics Division, Office of The Surgeon General, War Department,
Washington, D. C.

Table 17

Admissions to Hospitals and Quarters, Battle Casualties
Total Army, Continental United States, and Theaters of Operations, U. S. Army
Cases and Rates per 1000 Strength per annum, by years,
January 1942 to June 1945, Inclusive

Theater	Total		1942		1943		1944		1945	
	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate
Total Army	638913	30	4135	1.4	41862	6.2	355624	47.3	237292	61
Total Overseas	638913	79	4135	8.1	41862	26.3	355624	101.6	237292	98
Continental United States	0		0		0		0		0	
North America	1	0.005	0	0	0	0	0	0	1	.06
Latin America	2	0.005	0	0	1	.01	1	.01	0	
Africa-Middle East	364	3	38	6.6	293	5.49	28	.59	5	.21
Alaska	1307	5	60	1.2	1238	10.8	8	.1	1	.04
China-Burma-India	3980	12	16	2.8	295	6.4	2854	17.9	815	7
Pacific Ocean Area	41911	40	740	5.0	4502	15.3	12040	30.5	24629	119
Southwest Pacific	65158	54	1596	23.8	2234	11.45	18885	34.1	42443	109
Mediterranean	130702	97	1519	71.2	31057	72.0	86695	131.4	11431	47
European	395488	124	166	2.3	2242	8.5	235113	159.6	157967	115

Source: Medical Statistics Division, Office of The Surgeon General, War Department,
Washington, D. C.

Table 18

Admissions to Hospitals and Quarters

All Causes, Total Army, Continental United States, and Theaters of Operations, U.S. Army
Cases and Rates per 1000 Strength per annum, by years

January 1942 to June 1945, Inclusive

Theater	Total		1942		1943		1944		1945	
	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate
Total Army	16680469	788	2346029	769	5830471	867	5572491	742	2931478	756
Total Overseas	7115041	885	416529	811	1624228	1019	3040155	869	2034129	837
North America	111824	659	33578	828	49032	684	22291	529	6923	447
Alaska	197689	728	41243	821	93705	817	50332	605	12409	530
Continental United States	9565428	728	1929500	760	4206243	819	2532336	631	897349	622
Pacific Ocean Area	780231	747	88931	603	277943	942	277145	703	136212	657
Latin America	268142	769	96044	934	95503	789	52444	610	24151	619
European	2466196	775	59070	812	249817	946	1103751	749	1053558	768
China-Burma-India	344327	1036	6427	1130	49824	1081	189955	1191	98121	811
Africa-Middle East	138379	1062	8749	1525	66835	1253	47208	996	15587	653
Mediterranean	1459217	1079	13177	618	501751	1164	735809	1115	208480	866
Southwest Pacific	1349036	1119	69310	1035	239818	1228	561220	1013	478688	1229

Source: Medical Statistics Division, Office of The Surgeon General, War Department, Washington, D.C.

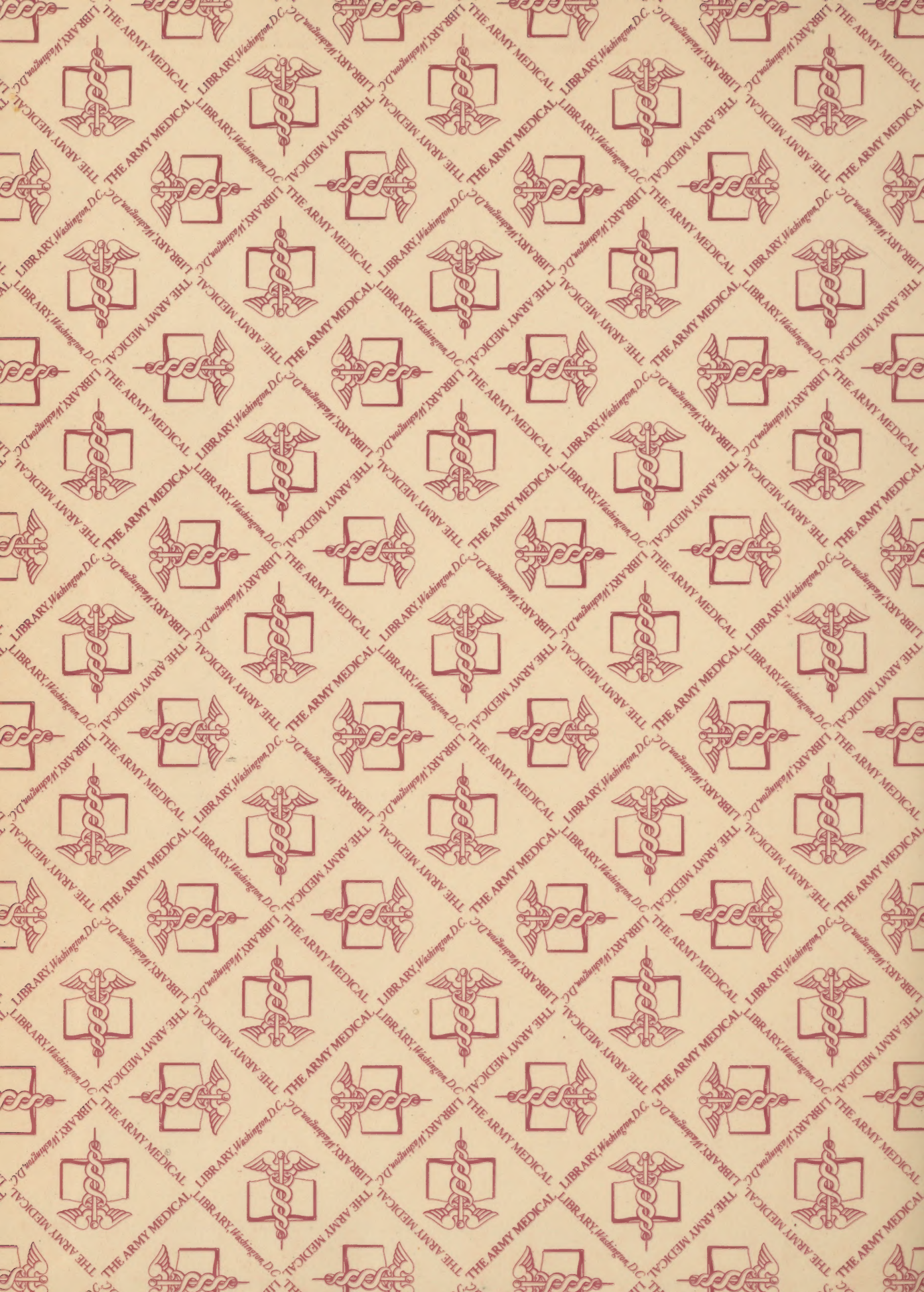
FIGURES

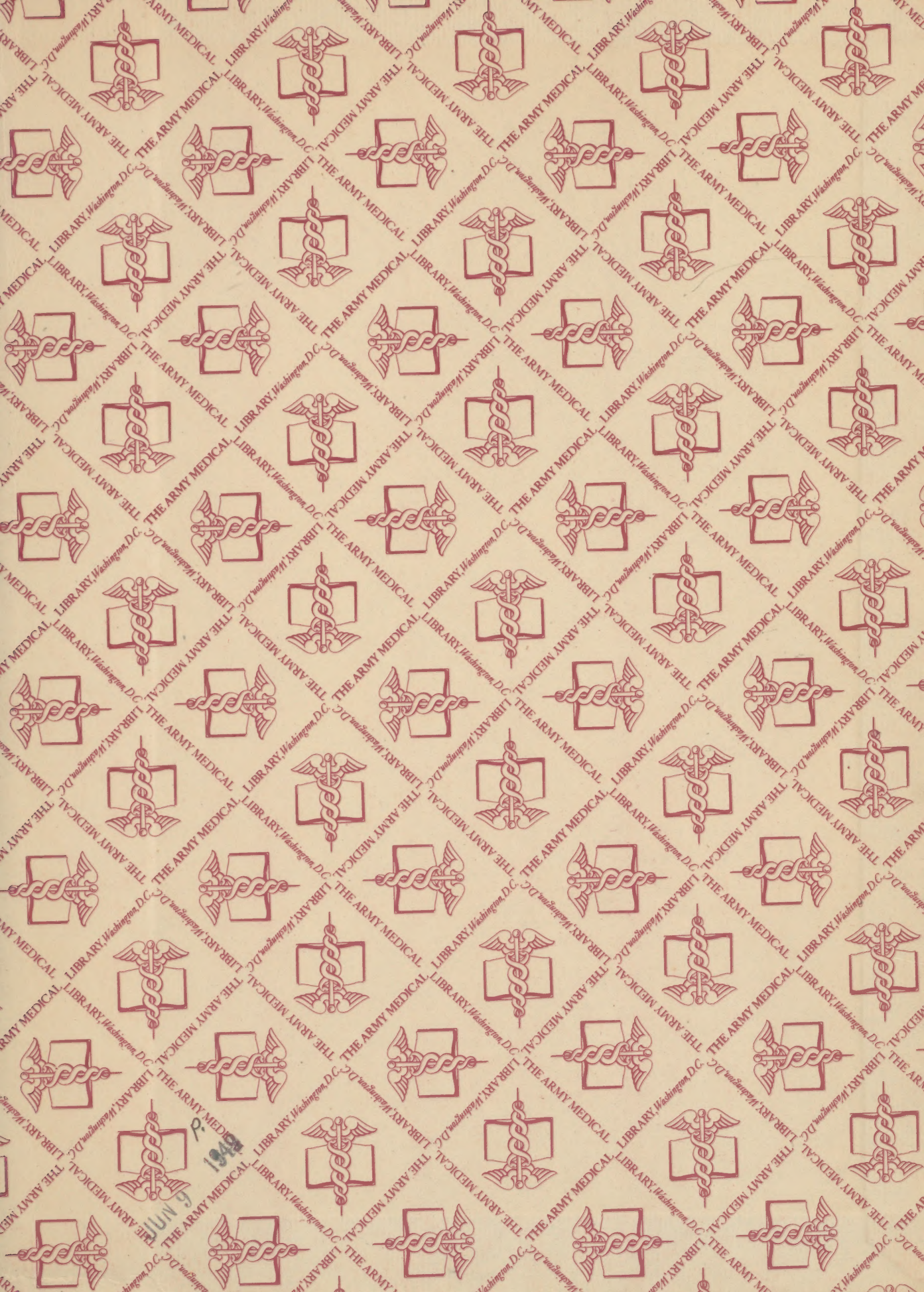
1. The maintenance of health is a function of command. General Dwight D. Eisenhower, Supreme Allied Commander, examines the field jacket of a soldier at the 16th Reinforcement Depot, February 1945.
2. Medical care of the sick and wounded is the first obligation of the Medical Corps. The 45th Field Hospital at Weissensee, Germany, April 1945.
3. Good hospital care decreases non-effectiveness. A patient with a lung wound in the shock ward of an evacuation hospital, France, July 1944.
4. The prevention of disease limits hospital admission. Drinking water is tested for its chlorine residual, 26th Infantry Division, Luxembourg sector, January 1945.
5. Medicine is many sided. Dental care in the 26th Infantry Division, Germany, February 1945.
6. The protection of the food supply is fundamental to prevention of disease. Inspection of frozen poultry by an army veterinarian at a cold storage plant in Paris, February, 1945.
7. Precision furthers accomplishment. Laboratory service at the 5th General Hospital, Northern Ireland, November 1942.
8. Causes of death in World Wars I and II, troops of the AEF and of the European Theater of Operations, U.S. Army, average rates per 1000 strength per annum.
9. Average daily non-effective rates per 1000 strength, European Theater of Operations, U.S. Army, by months, February 1942 to June 1945, inclusive.
10. Average daily non-effective rates per 1000 strength, disease, non-battle injury and battle casualty, European Theater of Operations, U.S. Army, January 1944 to June 1945, inclusive.

TABLES

1. Admissions to hospitals and quarters, all diseases, European Theater of Operations, U. S. Army, cases and rates per 1000 strength per annum, by months, February 1942 to June 1945, inclusive.
2. Admissions for neuropsychiatric conditions, hospitals and quarters, European Theater of Operations, U. S. Army, cases and rates per 1000 strength per annum, by months, February 1942 to June 1945, inclusive.
3. Admissions to hospitals and quarters, non-battle injuries, European Theater of Operations, U. S. Army, cases and rates per 1000 strength per annum, by months, July 1942 to June 1945, inclusive.
4. Admissions to hospitals and quarters, battle casualties, European Theater of Operations, U. S. Army, cases and rates per 1000 strength per annum, by months, August 1942 to June 1945, inclusive.
5. Admissions to hospitals and quarters, all causes, European Theater of Operations, U. S. Army, cases and rates per 1000 strength per annum, February 1942 to June 1945, inclusive.
6. Admissions to hospitals and quarters, all diseases, Continental Europe and United Kingdom, European Theater of Operations, U. S. Army, cases and rates per 1000 strength per annum, by months September 1944 to June 1945, inclusive.
7. Admissions to hospitals and quarters, neuropsychiatric diseases, Continental Europe and United Kingdom, European Theater of Operations, U. S. Army, cases and rates per 1000 strength per annum, by months, September 1944 to June 1945, inclusive.
8. Admissions to hospitals and quarters, non-battle injuries, Continental Europe and United Kingdom, European Theater of Operations, U. S. Army, cases and rates per 1000 strength, by months, September 1944 to June 1945, inclusive.
9. Admissions to hospitals and quarters, battle casualties, Continental Europe and United Kingdom, European Theater of Operations, U. S. Army, cases and rates per 1000 strength per annum, by months, September 1944 to June 1945, inclusive.
10. Admissions to hospitals and quarters, all causes, Continental Europe and United Kingdom, European Theater of Operations, U. S. Army, cases and rates per 1000 strength per annum, by months, September 1944 to June 1945, inclusive.

11. Deaths from all causes, European Theater of Operations, U.S. Army, number and rates per 1000 strength per annum, by years, February 1942 to June 1945, inclusive.
12. Deaths from infectious diseases, European Theater of Operations, U. S. Army, number and rates per 1000 strength per annum, by years, February 1942 to June 1945, inclusive.
13. Average daily non-effective rates per 1000 strength, European Theater of Operations, U. S. Army, by months, February 1942 to June 1945, inclusive.
14. Average daily non-effective rates per 1000 strength for disease, non-battle injury and battle casualty, European Theater of Operations, U. S. Army, January 1944 to June 1945, inclusive.
15. Admissions to hospitals and quarters, all diseases, Total Army, Continental United States and Theaters of Operations, U. S. Army, cases and rates per 1000 strength per annum, by years, January 1942 to June 1945.
16. Admissions to hospitals and quarters, non-battle injuries, Total Army, Continental United States and Theaters of Operations, U.S. Army, cases and rates per 1000 strength, per annum, by years, January 1942 to June 1945.
17. Admissions to hospitals and quarters, battle casualties, Total Army, Continental United States and Theaters of Operations, U. S. Army, cases and rates per 1000 strength per annum, by years, January 1942 to June 1945, inclusive.
18. Admissions to hospitals and quarters, all causes, Total Army, Continental United States and Theaters of Operations, U. S. Army, cases and rates per 1000 strength per annum, by years, January 1942 to June 1945, inclusive.





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